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THE SPINY-RAYED GAME FISHES OF THE CALIFORNIA INLAND WATERS

By GEORGE NEALE

He is an unfortunate angler who can not recall an exciting experience and conjure up a story or two when someone mentions the term bass, be it described as black, striped or calico. The bass, which are relatively strangers in the State, have not only been given the full hospitality of our waters but the efforts of the Bureau of Fish Rescue and Reclamation have been directed to the end of making their residence permanent.

The bass, together with the sunfishes and perch, belong to a great group of fishes which are distinguished by the presence of stiff, unjointed rays or spines in the dorsal and anal fins, in addition to the flexible, jointed rays characteristic of such a fish as the trout. It is due to this feature that the group, or order, derives the scientific name *Acanthopterygii* (acanthos-spiny, pterygous-wing or fin)—the spiny-rayed fishes.

The writer does not propose to offer a scientific treatise on this group but feels that the reader may be interested in some of the information he has derived throughout a period of more than thirty years of practical experience in the field. During this time he has taken an active part in the distribution and, in some cases, the original importation of these fish into the waters of California.

As suggested above, the spiny-rayed game fish of the lakes, streams and rivers of California have, with the one exception of the Sacramento perch, been purposely introduced from distant territories.

The story of their importation from waters east of the Rockies is an interesting bit from the history of California, and well illustrates the desire of those people who traveled westward to have about them reminders of the pleasures of their old home.

The introduction of foreign fish has not been without consequent problems, for all animals are so integrally bound up in their relations with one another and with the plant life that one can scarcely foretell the results when a new animal is introduced into the tangle.

The large-mouthed black bass, for instance, has thrived in its new home with possibly greater success than in its old amid the waters of Lake Champlain. What changes in the animal and plant life have resulted from its presence in California? Has its prosperity been gained at the expense of some other fish?

Contrasting with the success of this stranger, the native Sacramento perch, once so abundant, has shown a decided decline in numbers. Why? One observer notes that they have an appetite for the young of an introduced catfish. These young, it appears, are armed with spines in the dorsal fins which are efficient weapons for tearing the tissues of the stomach of the perch which swallows them. But, to complicate this explanation, it appears that the striped bass, crappie and green sunfish also feed on the young catfish without noticeable injury.

While the angler baits his line with an attractive minnow for the bass, the fishes, in their turn, offer these interesting problems as bait for the naturalist interested in preserving those species most desirable to sportsmen and eater.

There are a very considerable number of species belonging to the spiny-rayed group in California and we shall list only those entitled to the privilege of being called fresh-water game fish. This list includes the striped bass, the large- and small-mouth bass, the crappie, the calico bass, the fresh-water rock bass and the Warmouth bass. Among the sunfishes are the blue gill and green sunfishes, the yellow perch and the Sacramento perch. Because of their importance in relation to the spiny-rayed fishes, we have included brief accounts of the bullhead or square-tail catfish, the mud or forked-tail catfish, the carp and the shad though these of our fish are not members of the order *Acanthopterygii*.



BLUEGILL, *Helioperca incisor* (Cuvier and Valenciennes)

There are interesting differences in the behavior and life history of each of these fishes, for no two kinds of animal life are in identical relationship with their environment. Furthermore, the behavior of each species will vary from time to time and place to place in accordance with changes in their environment.

The spawning season of the black bass, crappies and sunfishes, for instance, varies considerably according to the temperature of their locality. In shallow, warm water they spawn from March 1 to June 30; in the colder deep water from after April 1 to July 15; and in the higher altitudes as late as July 1 to August 15.

There are times between catches when the angler is afforded excellent opportunity for a study of the fish in his basket and few fish are more appropriate for the purposes of study than the bass. According to the scientists, the bass is a generalized fish, *i.e.*, its structure conforms to that expected of an animal that lives in the water. In the place of arms and legs, it bears fins. Two sets of these fins correspond respectively to the fore and hind limbs of the higher animals—the pectoral and pelvic or anal fins. In addition to these there is an appendage on the upper side of the fish termed the dorsal fin, and another at the posterior end known as the caudal fin. The caudal fin is the main agent of locomotion for fish, the others serving principally to maintain balance and depth in the water.

The structure of any given fish is admirably designed in accordance with the particular type of water in which it lives and its behavior in the acquisition of food. If one were to become thoroughly familiar with the life and activities of any fish, he could discover a logical reason for any peculiarity of structure that it might have. It is true, however, that many fish bear structures that have a function in ages past, but through some change in their environment they have become useless and usually appear only as vestiges. Those fish having a light colored belly will be found for instance near the surface of waters, whereas the fish which prefer the bottom of the stream will have a belly—ventral surface—noticeably darker in color.

Extending along the sides of all fish is a well defined line which varies considerably in contour according to the species. This is known as the lateral line. It is a sense organ, probably of as great value to the fish as are the ears or eyes of the higher animals. The lateral line in fish has been the subject of much investigation by scientists and there are many interesting speculations as to its exact function.

For the details of the head, the reader may refer to Figure 1. The head is built up of two types of bone—the calcareous bones, which form a greater part of the skull proper, and the membrane bones of which the operculum and the preoperculum are examples. The operculum serves as a protection for the gill arches on which are found the gills and their rich supply of blood vessels. The fish inhales water through the mouth producing a current which flows to the exterior over the gills and out through the operculum.

Attached to the gills are structures known as gill rakers which serve as strainers for the food material entering the mouth. The oxygen dissolved in the water is retrieved by the delicate membranes of the gills and after being transported through the blood stream serves as the fuel necessary for the metabolism of the animal.

On the fish forms under discussion, we may discover two types of scales—the ctenoid and the cycloid. Ctenoid is a term derived from the Greek *ctenos* meaning a comb. The scales of this pattern are attached to the skin of the fish by a number of small comb-like projections. The cycloid scales are almost circular in shape. If one were to place a fish scale under the microscope, he would note that it is striated with a number of concentric rings or annulations. These rings, similar to the rings of growth in a tree, are accurate indicators of the age of the fish.

You will note that the eye of a fish possesses no eyelid, also that there are no external ears. The eyes of a fish are not capable of discerning the details of objects. Consequently, the appearance of any moving form causes the fish to dart for protection among the rocks or grass of the stream.

In our study of other animals, we are prone to interpret their reaction in terms of our own senses, but in our speculations concerning the fish we must appreciate that it lives in an entirely different environment from ours. The thoughtful angler, and it is taken for granted that anglers are thoughtful, may, between casts, find it profitable both to observe and speculate concerning the reactivities of those animals which live as successfully in their environment as we do in ours.

Let us briefly describe in the following pages the more prominent game fishes to be caught from the fresh waters of our State:

HOW TO IDENTIFY THE SPINY-RAYED GAME FISH OF THE CALIFORNIA WATERS

The most convenient means for the determination of the species of an animal is by the use of a so-called *key* such as the one that follows. In this key are listed those characters or structures which, when taken together, distinguish one group of fish from another. Some structures are common to many different kinds of fish but not to all fish. For instance, all of the fish on our list bear ventral fins attached to the thorax under, or slightly behind, the pectoral fins. (See Fig. 1.) Examine a trout or sardine and you will notice that the ventral fins are considerably behind the pectoral fins.

If the reader will refer to the key for the identification of the sunfish family, he will note in reading from numeral 1 to letter A to a and b, that the characters become more restrictive, until finally, if the key were carried to its limit, there would be a small group (species) of fishes having a number of characters different from those of any other kind of fish. The calico bass, according to the key, bear different markings from the white crappie though they may each carry, at times, the same number of dorsal spines. Thus, by a process of gradually restricting the characters, a key enables one to trace a specimen to a point where it belongs to one group and no other.

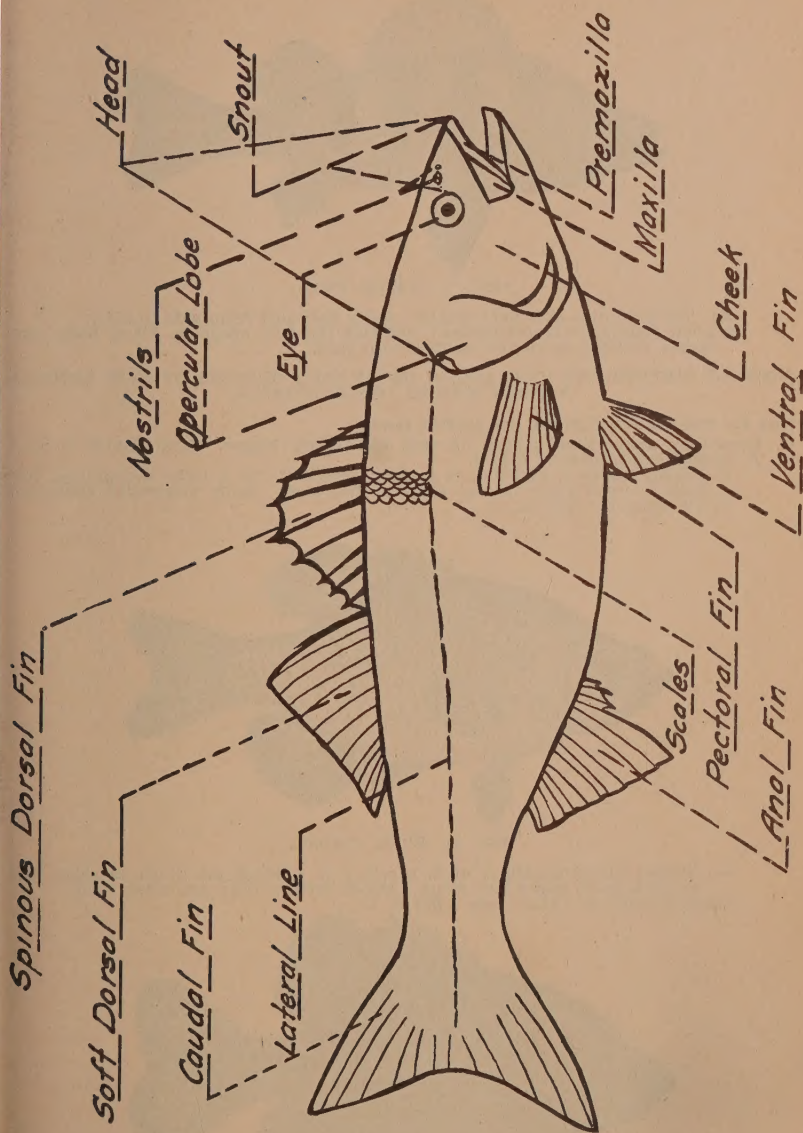


Fig. 1. Outline drawing of Striped Bass to show characteristics of spiny-rayed fish.

- 1 Ventral fins attached to thorax under or slightly behind pectorals.
 - A. Dorsal fin consists of two parts. The anterior part is composed of sharp, stiff spines; posterior part is made up of soft rays.
 - a. One or two slender anal spines. Body elongated.
- Perch family: (Percidae) includes the yellow perch, the only species of importance to be found in California. See p. 12.



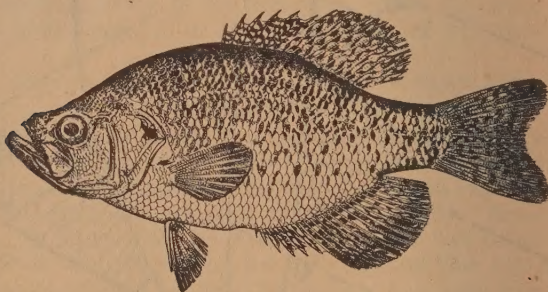
*FIG. 2. Yellow Perch.

aa. Three to nine stiff anal spines. Body flattened from side to side.
Sunfish family: (Centrarchidae) includes the two crappies, black bass, sunfishes, bluegill, large and small mouth bass.

HOW TO DISTINGUISH THE SEVEN IMPORTANT SPECIES OF THE SUNFISH FAMILY FOUND IN CALIFORNIA

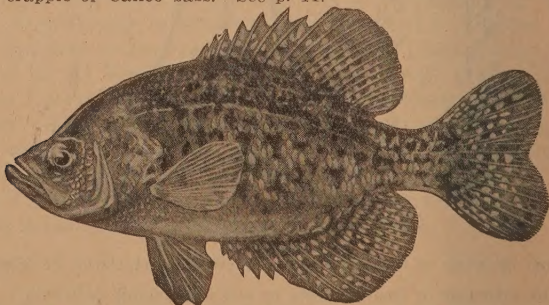
Key for the identification of the sunfish family.

1. Dorsal fin about same length as anal or slightly longer. Anal spines, 6 or 7.
 - A. Dorsal spines usually 5 to 8.
 - a. Dorsal spines 6, rarely 5 or 7, dark cross-bars on a light background that tend to form rings on the sides of the body. Body somewhat elongated. White crappie. See p. 11.



*FIG. 3. White Crappie.

aa. Dorsal spines usually 7 or 8, rarely 6 or 9, black markings on sides tend to form spots instead of rings. Depth greater than preceding form. Black crappie or Calico bass. See p. 11.



*FIG. 4. Calico Bass.

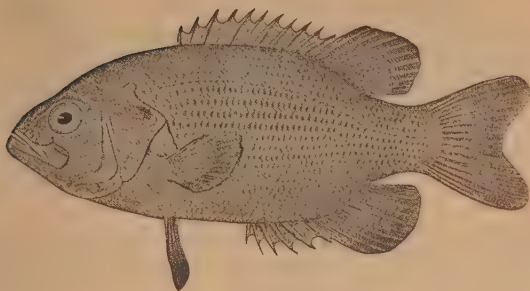
- AA. Dorsal spines 11, rarely 10 or 12.
 - a. Red eye; bronze color with small square black spots on sides forming stripes that run lengthwise of the body. Rock bass. See p. 11.



WHITE CRAPPIE, *Pomoxis annularis* Rafinesque



BLACK CRAPPIE, *Pomoxis sparoides* (Lacépède)



*FIG. 5. Rock Bass.

AAA. Dorsal spines 12 or 13.

a. Color blackish above; sides, silvery with about seven vertical blackish bars, irregular in form and position and more or less interrupted. Sacramento perch. See p. 12.

2. Dorsal fin over twice the length of anal; anal spines 3.

A. Spinous and soft rayed portions of dorsal fin not separated by a deep notch. Body short and deep. Length exclusive of tail about twice depth. Never three times depth of body.

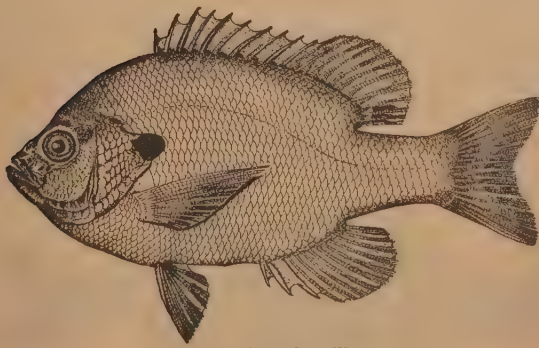
a. Rim on outside of black spot on gill cover soft and flexible; rim on inside of gill cover stiff and bony.

aa. Mouth large; large black spot at rear of soft dorsal and one at rear of anal. Dorsal spines low. Color dark green, usually with blue spots. Green sunfish.

b. Black spot on gill cover thin and flexible throughout.

bb. Black flap on gill cover without pale margin, and not elongated or projecting upward. Dorsal spines high. Large black spot at rear of soft dorsal. Color olive with purplish luster.

Bluegill. See p. 11.



*FIG. 6. Bluegill.

AA. Spinous and soft-rayed portions of dorsal fin separated by a deep notch. Body elongated. Length exclusive of tail approximately three times depth.

a. Maxillary bone does not extend beyond eye, except in very old specimens. Eye red. Mouth moderate in size. 10 or 11 lengthwise rows of scales above the lateral line. Spinous dorsal long and low with very little variation in height. Color golden green with dark cross-bars. Small-mouth black bass. See p. 10.



*FIG. 7. Small-Mouth Black Bass.

aa. Maxillary bone in adults always extends back of eye. Eye not red in adults. Large mouth. 7 or 8 lengthwise rows of scales above the lateral line. Spinous dorsal high in the middle forming a half circle. Color dark green. Black lengthwise streak along each side of body; except in large individuals.
Large-Mouth black bass. See p. 9.

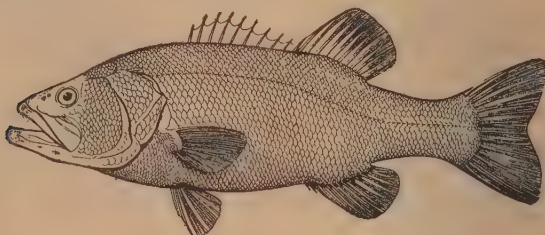


FIG. 8. Large-Mouth Black Bass.

Key for the Identification of the catfishes.

IF: The tail fin is cut squarely off at the end or is slightly rounded inwardly (not formed or rounded deeply), the fish is a square-tail catfish. See p. 13.

BUT IF: The tail fin is forked or deeply rounded inwardly, the fish is a fork-tail catfish.

Striped Bass (*Morone saxatilis*)

Relationship: Order, Acanthopterygii; family, Serranidae—the sea bass.

Specific characters: Body deep and compressed; lower jaw projecting; dorsal fins entirely separate; three anal spines; graduated in size; scales large, ctenoid; silver-grey color with well-defined dark grey longitudinal stripes along the back. The average size is from four to eight pounds, though specimens have been taken having a weight of over eighty pounds.



FIG. 9. Striped Bass.



PLATE I. Striped Bass, *Roccus lineatus*.

Nativity: In 1879 one hundred and seven individuals were transplanted from the Navesink River, of New Jersey, to the Carquinez Straits. In 1882, three hundred young fish were transferred from the Shrewsbury River to Suisun Bay.

Distribution in California: The coast waters from the Oregon boundary to San Diego Bay; the Sacramento and San Joaquin rivers, their tributaries and a number of streams and lakes in southern California.

Fishing season: There is no closed season for the angler but there are certain legal restrictions concerning which the reader may refer to the fish and game laws of California. Two migrations occur: the spawning migration which begins during March and extends into June, and the "winter bass run" usually commencing in September and continuing from two weeks to two months. The latter is primarily a feeding run.

Fishing methods: A rod and reel or hand line is used when casting from a boat or the shore or while trolling. These fish are omnivorous feeders and take a wide range of baits among which sardines, shrimps, clams, squib and live minnows are popular. The bait hooks used are usually Nos. 5, 6, or 7. Artificial lures: Stewart and Wilson's spoons Nos. 4, 5, and 6; Basserrins, red head and lucky 13, and Heddon wiggler, dark or light according to the turbidity of the water. Use a heavy sinker when still fishing; when trolling, use at least a hundred feet of number 9 line and no sinker. These fish tend to swim in schools and once a strike is made in an area it may be repeatedly worked.

Notes: This is unquestionably one of the most desirable combination of game and commercial fish that migrates into fresh water. The flavor, when broiled or baked, is delicious and there are relatively few bones.

An excellent article on the California striped bass may be found in the CALIFORNIA FISH AND GAME for April, 1926, Vol. 12, No. 2.

In external features the bass represents a *generalized* bony fish, *i.e.*, its form is typical of fishes in general and it possesses no character such as fins, tail or mouth which have become highly modified.

Large-Mouth Black Bass (*Micropterus salmoides*)

Relationship: Order Acanthopterygii; family Centrarchidae. This is a member of the sunfish family—spiny-rayed fish only found in fresh waters.

Specific characters: The only difficulty in determining the large-mouthed black bass exists in the ability to distinguish it from the small-mouth bass—another species of the same genus. In the large-mouth form the maxillary extends beyond the eye, the scales of the cheek are nearly as large as those of the body and the ten dorsal spines make a decidedly more acute curve than those of the small-mouth species *i.e.*, the dorsal fin is decidedly notched. The large-mouth is stockier in form and darker in color than the small-mouth, with longitudinal markings more pronounced. Length, 15 to 18 inches.

Nativity: The large-mouth bass is involved with the small-mouth in its introduction and we shall combine the history of both forms. In 1874, Dr. Livingstone Stone imported 75 full-grown spawning bass from Lake Champlain, Vermont, and 24 small fish from St. Joseph River,

Michigan. Both of these shipments were most probably of the small-mouth variety. The first shipment was placed in Napa Creek and the 12 survivors of the second in Alameda Creek. In 1879 he made a second shipment of 22 mature fish which were planted in the Crystal Springs Reservoir, San Mateo County. These fish increased rapidly and, later, hundreds of their progeny were consigned to various waters of the state. The United States Commission in 1891 deposited 2000 yearling large-mouth bass in Lake Cuyamaca, San Diego County, and 620 in the Feather River near Gridley. In June 1895, at the request of the California Commission, the United States Commission delivered 2500 large-mouth bass fry which were placed in the ponds of Sisson Hatchery from which station they were widely distributed in the northern and southern parts of the state.

Distribution in California: These fish have been widely distributed throughout the state and in the majority of the waters they have reproduced very successfully.

Fishing season: The fishing season corresponds with that of the Sacramento perch, crappie or any of the other sunfishes. There are certain restrictions and limits for which refer to the California fish and game laws.

Fishing methods: These fish, due to certain limitations in their mouth parts, are not such omnivorous feeders as the striped bass. They will take a minnow, a snail, or a worm and a variety of artificial lure. Both the large and small-mouth bass will put up a good fight and the fishing methods are similar to those used for any of the sunfish.

Notes: The male of this species builds a crude nest in shallow water. Then, seeking his mate, he attracts her to the nest. After the eggs are laid, he drives her away and personally guards the nest until the young are well grown.

Small-Mouth Black Bass (*Micropterus dolomieu*)

Relationship: The same as that of the large-mouth bass.

Specific characters: The maxillary reaches only to the front of the eye and the head is one-third the length of the body. There are 10 soft rays in the anal fin as compared to the 11 which are characteristic of the large-mouth species. There is no decided notch in the dorsal fin of the small-mouth and it is more slender and lighter in color than its large-mouth cousin, also, the stripes on its cheeks are more prominent.

Nativity: See the data under *Micropterus salmoides*.

Distribution in California: This species is more exacting in its choice of environment than any other member of the spinous group. Shunning the sluggish waters of the valleys, they share with the trout the clear, cold water habitat of the gravel and rock-bottomed mountain streams. Their food habits resemble those of the trout and, like them, they are found in the cold streams from Canada southward.

Fishing season: The same as that for the large-mouth bass.

Fishing methods: The small-mouth will rise to a fly, take a spinner, live minnows or a frog. They are uncertain in their time of feeding and decidedly temperamental in their feeding habits. The angler must not expect much sport from bait fishing but there is a decided thrill resulting from their rush to the moving lure.





PLATE II. Large-mouth Black Bass, *Micropterus salmoides*.
Courtesy of the Canadian Pacific Railway Company.



PLATE III. Small-mouth Black Bass, *Micropterus dolomieu*.
Courtesy of the Canadian Pacific Railway Company

Notes: The small-mouth bass is the peer of its family from the sportsman's viewpoint. It is a fitting rival of the trout and has a flavor equally delicious.

Crappie (*Pomoxis annularis*)

Calico Bass (*Pomoxis sparoides*)

Relationship: These are spiny-rayed members of the same family as *Micropterus*. Since the two forms are so similar in character, habits and appearance, we shall describe them under the same heading.

Specific characters: In addition to those given in the key, the following features may aid in determining the difference between the crappie and the calico bass. The crappie is not so deep or robust as the calico bass; its mouth is somewhat larger and the snout more prominent. The eye of the former is slightly larger and the membrane of the jaws is noticeably thin and transparent—a feature from which it derives the popular name of “tin-mouth.” There are six spines in the dorsal fin of the crappie and seven in that of the calico bass.

Nativity: Both species were introduced from Illinois in the early nineties. They were not widely distributed at that time, but in 1901 a shipment to Sacramento was extensively released.

Distribution in California: These fishes are numerous in the Sacramento and San Joaquin valley waters and abound in nearly all sloughs, dredger cuts, canals, lakes and rivers where the current is not too swift.

Fishing methods: These fish afford good sport with a light tackle and, in clear water, will rise to a fly, take a worm or grasshopper. They are partial to a small spinner when fished deep near the edge of weeds or any aquatic growth where the black bass like to wait for their prey. Use the lightest tackle with Nos. 3 to 5 hooks on gut snells. Fly fishing is more successful during the late afternoon hours and the gray drake, black gnat or any of the hackles on hooks Nos. 4 or 5 are recommended.

Bluegill Sunfish (*Heliperca incisor*)

Green Sunfish (*Apomotis cyanellus*)

Relationship: The same family as the crappie and calico bass.

Specific characters: These fish belong to a group which the scientists have found difficult to classify. The external characters which serve to distinguish one species from the other are best gained from observation of the pictures herein published.

Distribution in California: The flood waters of northern California rivers and streams have tended to give these species a wide distribution. They show a decided preference for clear, still waters where there is plenty of aquatic growth.

Fishing methods: Use a light rod and any of the tackle which might be selected for trout.

Notes: Any of these three fish are particularly recommended as a table delicacy and, as to fighting qualities, they compare with any fish of similar size.

Rock Bass (*Ambloplites rupestris*)

Relationship: Order Acanthopterygii; family Centrarchidae—the same group as the crappie, calico bass, Sacramento perch, etc.

Specific characters: This fish resembles the black bass though it is noticeably deeper and more compressed. The dorsal and anal fins

are longer and stronger than those of the bass. It is quickly distinguished by the scarlet iris of the eye from whence it derives the popular name "red eye."

Nativity: Introduced into California in 1891 from Illinois.

Distribution in California: The rock bass have not thrived so abundantly as other members of the family and but very few are found in waters where there are no other bass.

Fishing season: The same as for black bass, calico bass and the other sunfish. See fish and game laws.

Fishing method: A light four or five-ounce fly rod and trout flies Nos. 5 to 7 make an excellent tackle. The flies must be allowed to sink with every cast. Live minnows make good bait and there is good sport derived from trolling with a small spoon.

Notes: This bass spawns in the spring and early summer. Like the black bass, the male builds a nest which it guards until the young are able to take care of themselves.

Yellow or Ring Perch (*Perca flavescens*)

Relationship: The family percidae of the spiny-rayed order.

Specific characters: This is the most colorful of any of the fish of our group and is easily distinguished by its dark olive back, golden yellow sides and pinkish belly. The lower fins are usually bright red or orange and the body is striped with six or more broad, dark bands.

Nativity: Introduced into California in 1891 from the state of Illinois.

Distribution in California: Like the rock bass, which accompanied them in their introduction to California, the yellow perch has been only moderately successful. They will rarely be found in waters where there are no bass.

Fishing season: The same as that for the rock bass.

Fishing methods: The methods to be used are similar to those applied with the rock bass or the other members of the group weighing from a half to over a pound.

Notes: The yellow perch run in schools and all the members of a given school are similar in size. The young are striking in appearance and apparently attractive to the bass who attack them with avidity.

Sacramento Perch (*Archaplites interruptus*)

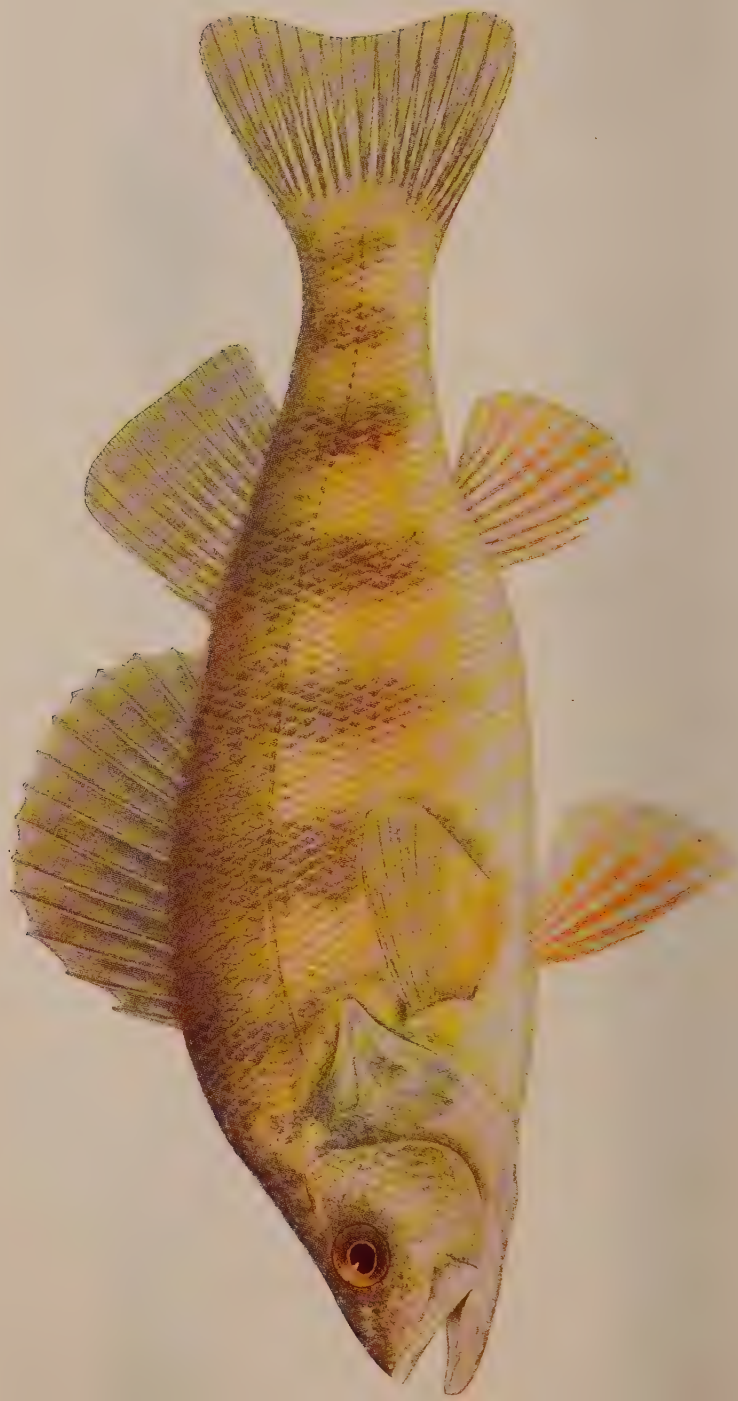
Relationship: The Sacramento perch is a member of the family Centrarchidae and is closely allied in structure to the fresh water rock bass.

Specific characters: Its form is similar to that of the rock bass, but it differs in having more teeth on the tongue and a greater number of gill-rakers. It differs considerably in color being uniformly black or brassy. It displays several irregular vertical bars and there is a black spot on the angle of the gill cover.

Nativity: This is the only fresh water, perch-like fish indigenous to waters west of the Rockies. It was named in 1854 by Girard.

Distribution in California: The waters of the Sacramento and San Joaquin rivers. It has noticeably decreased in numbers during the past few years. (See notes below).

Fishing season: The same as that for other sunfish.



YELLOW PERCH, *Perca flavescens* (Mitchill)



FIGURE VIII. *Scorpaenopsis formosa*, *Scorpaenopsis lateralis*.

Fishing methods: Similar to those for the rock bass.

Notes: The eggs of the perch are held together by a gelatinous substance and laid in long strings which become draped over sub-aquatic plants and submerged roots. Thus, they are conspicuous in the water and attract the attention of the catfish and carp who eat them in large quantities. The balance of animal life that was once so favorable to these little perch, changed with the introduction of the carp, catfish, striped bass, etc., and today it may only be found in those few places where the foreign species are rare or absent.

There are three fish, the carp, the catfishes and the shad, which, though not members of the spiny-rayed game fish, bear such an economic relation to the latter that it is deemed relevant to include them in this paper.

Carp (*Cyprinus carpio*)

The carp is also a stranger in California and the desirability of its importance is somewhat questionable for, though it has positive values, this much-traveled oriental is accused of being a decided food competitor of the larval bass in addition to consuming the spawn of many game fishes.

Five individuals were brought from Holstein, Germany in 1872, their forefathers having been introduced into Europe from China. In 1877, the California Commission received some 88 carp from the Japanese government in exchange for a consignment of trout eggs. In 1879 and again in 1882, lots amounting to 297 fishes were received from the federal government.

The carp makes a pleasing food when properly prepared and may sometime gain in popularity though, at present, little carp rescue is carried on by the Bureau of Fish Rescue and Reclamation of the Division of Fish and Game.

The Catfishes—Order Nematognathi, the thread-jawed fishes

Square-tail Catfish (*Ameiurus nebulosus*)

Fork-tail Catfish (*Ameiurus catus*)

Both of the above fishes were transplanted from Vermont and New Jersey in 1874. They seem to have thrived better in California than in their native waters of the east and middlewest.

The value of the catfish as a delicious table delicacy has only been appreciated by the California appetite during very recent years. Apparently too cheap and ugly to make an appeal in our local markets, they have been profitably shipped in great numbers to the markets of states from which they originated. They may be caught with almost any bait in fresh waters where there is a mud bottom.

The Shad (*Alaso sapidissima*)

The shad was the first foreign species to be introduced into California. On June 17, 1871, Mr. Seth Green left New York with 12,000 young shad fry. Of these, 1000 survived the trip and were planted in the Sacramento River at Tehama. Their success is attested by the hundreds of tons that are annually sold in the state and exported elsewhere. They are partial to fresh shrimps, put up a good fight and, during the seasonal run in the Sacramento and larger streams, they make excellent fishing with light tackle.

CONSERVATION

None of the spiny-rayed fishes are propagated in the state hatcheries for, but with one exception, the eggs can not be taken from them and hatched as are those of the trout and salmon. Replacements, therefore, must be made from the natural spawning areas.

Possibly one of the most important works of conservation instituted by the Department of Natural Resources, Division of Fish and Game, has resulted from the creation of the Bureau of Fish Rescue and Reclamation. By virtue of its endeavors, valuable food and game fishes that would become the prey of predatory birds and mammals when left stranded by receding waters are reclaimed and returned to permanent waters.

FUTURE SUPPLY ASSURED

The rescue bureau goes a step further than just netting and reseuing fish and returning them to the water from whence they came. Every advantage is taken to maintain a permanent supply and to distribute them to other adaptable waters, all over the state. In the seining operations, the parent fish, which are generally found with their young, are returned to the main bodies of water with about fifty per cent of the young fry. The surplus are used to fill the many applications for them, which are made to the fish cultural department. In this way a future supply is maintained and assured.

These natural outdoor hatcheries are so situated by nature that they could not be duplicated by artificial effort except at an immense cost. The propagating areas are formed generally in the lowest lands at the confluence of two streams, such as the Sacramento and American rivers or the Mokelumne and Cosumnes. These four streams alone with their tributaries furnish eighty per cent of all the spiny-rayed fish rescued and distributed to all parts of the state. An estimate of the area of these outdoor natural hatcheries in a normal winter of rainfall is about 70,000 acres of surface water, composed of small ponds and lakes and overflowed areas, of from one to four hundred acres each. Nearly all of this area is connected at flood water with some important river or laké, where these fish abound.

The most essential elements in all waters containing fish are food, spawning grounds and an abundance of subaqueous plant life, which furnishes both food and shelter for the young fish, and without which there can be little or no natural propagation. These natural hatcheries contain all of these elements, their propagation costs nothing, they require no feeding as do artificially hatched fish, no buildings or attendants. There is no element of disease, no watchful eye of the fish culturist—nature does it all without cost, but when nature has completed her wonderful work, then conservation begins. The young and adult fish must be removed to permanent waters, over-fished waters must be stocked, barren waters must be supplied to furnish sport and food.

IMPORTANCE IN OTHER STATES

The states of Illinois, Iowa, Indiana, Kansas, Minnesota, Nebraska, Wisconsin, South Dakota, Louisiana, Missouri, Michigan, Connecticut, Ohio, Oklahoma, and a number of other states not so favored by trout waters as is California, derive a large portion of their license revenue





PLATE IX Square-tail Catfish, *Ameiurus nebulosus*

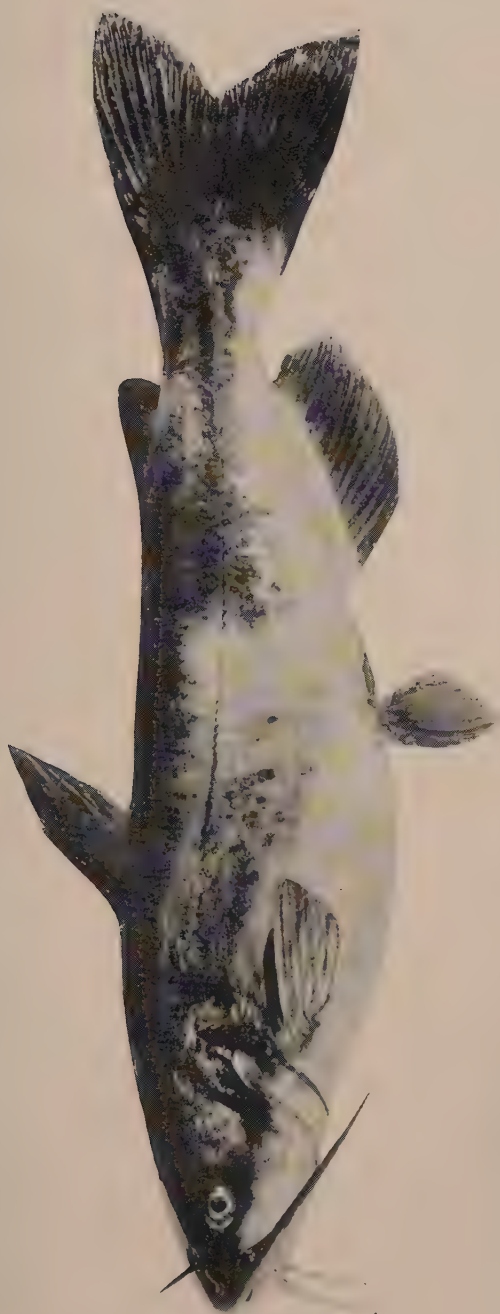


PLATE X. Fork-tail Catfish, *Ameiurus catfish*.

rom these spiny-rayed fresh water game fishes. They specialize ntirely upon the propagation of this tribe of fishes at a cost of from wenty-five to forty dollars per thousand.

With the single exception of the yellow perch, the spiny-rayed fishes an not be propagated artificially as are trout and salmon. They can not be stripped of their eggs as are trout, hence the necessity of these tates creating seminatural or artificial outdoor propagating ponds in order to maintain the demand by the anglers of these states. Many of these states expend a large amount of their income in the propaga- tion of these fish. Arkansas claims to maintain the largest acreage of propagation ponds in America—a series of ponds just completed at a cost of \$175,000. The state of Illinois operates eleven seminatural ponds for spinous fish. They also operate four rescue stations with crews. This would indicate the value of these game fishes to these states.

Such expenditures will not be necessary in this state, as long as the fish are rescued from the immense natural propagating areas in the Sacramento and San Joaquin Valleys. The growing demand for ooth large- and small-mouth black bass can be met by setting aside cer- tain natural ponds or lakes which may be acquired by rental and main- tained as bass propagating waters. There are many such ponds and reservoirs in the lower altitudes, in fact the chiefs of the Bureau of Fish Culture and Fish Rescue are now working on such a project.

**Total Number of Fish Rescued From August 1, 1928, to June 30, 1929
by Species**

Green sunfish	374,705		
Bluegill sunfish	65,407		
Crappie	29,231		
Striped bass	122,408		
Catfish	154,117		
Black bass	218,419		
Rainbow trout	3,435		
Salmon	350		
Yellow perch	1		
Sacramento perch	100		
		968,173	
Hanford Rescue crew }		{ 157,905	
Newman Rescue crew }	all species	{ 155,626	1,281,704

Total Number of Fish Rescued From July 1, 1929, to June 30, 1930

Green sunfish	2,249,623		
Bluegill sunfish	367,071		
Crappie, calico bass	927,453		
Catfish	252,765		
Striped bass	10,004		
Black bass	1,700,088		
Rainbow trout	40,140		
Salmon	156		
Sacramento perch	8		
		5,547,308	
Aided by volunteers of Sacramento County		141,313	5,688,621
Grand total rescued to June 30, 1930			6,970,325

Approximately 75 per cent of the rescued fish are what we have classed as number "ones," two inches or less in length. Twenty-two per cent are yearlings and 3 per cent are adults of all sizes. We have devised a system by which we are able to count small fish by small dip net measurement, which is approximately 98 per cent correct. All figures are very conservative.

One of the outstanding accomplishments of the Bureau of Fish Cul- ture and Rescue is the successful transportation and planting of two carloads of striped bass—5000 fish of from four to six inches in length to the Salton Sea in Riverside and Imperial counties. This body of

water is of a saline nature and is 45 miles in length and 15 in width. It is one of the most important experiments in fish introduction into waters of like character anywhere.

The following distribution of rescued fish to barren waters has been made possible by the fine cooperation given by the Bureau of Fish Culture and Distribution.

Season of 1928, August 7 to December

Diez Lake, Inyo County, Crappie, catfish, sunfish	1,200
Big Bear Lake, San Bernardino County, Catfish, sunfish	300
Ponds at Atherton, San Mateo County, Black bass	12
Steinhart Aquarium, San Francisco County, Black bass	24
Feather Hill Ranch, Santa Barbara County, Catfish, crappie	650
Altadena ponds, Los Angeles County, Sunfish	50
St. Mary's College, Contra Costa County, Sunfish, crappie	300
Searsville Lake, Santa Clara County, Bluegill, sunfish, crappie	100
Laguna Lake, Orange County, Catfish	150
Fairmont Lake and Evans Lake, Riverside County, Black bass, Sunfish, crappie, bluegill	1,515
Eagle Lake, Lassen County, Crappie, black bass, sunfish	1,322
Guadalupe Lake, Santa Barbara County, Catfish	300
Santa Anita Dam, Los Angeles County, Catfish, sunfish	?
Foss Lake, San Diego County, Catfish, sunfish, crappie	540
Henshaw Lake, San Diego County, Sunfish, crappie, catfish	695
Hughes Lake, San Diego County, Catfish	1,000
Riverside Lake, Riverside County, Black bass, crappie, sunfish	1,605
Corners Station, Kern County, Black bass, crappie, sunfish	664
Bakersfield Athletic Field, Kern County, Black bass, crappie, sunfish	700
Stanislaus River, Black bass, crappie, sunfish	1,822
Kings River, Kings County, Catfish	15,000
Cross Creek, Kern County, Catfish	40,000
Kaweah River, Tulare County, Catfish	40,000
Kern River, Kern County, Rainbow trout	137

Season of 1929

Lake at Redding, Shasta County, Sunfish, crappie	2 cans
Lake at Watsonville, Black bass	4 cans
Los Gatos, Black bass, crappie, sunfish	3 cans
Los Angeles, Black bass	8 cans
Vallejo, Black bass, crappie, sunfish	12 cans
San Diego, Black bass	126 cans
Susanville, Crappie	126 cans
Lincoln, Placer County, Black bass	2 cans
Redwood City, Catfish, crappie	2 cans
Lone Pine Chamber of Commerce, Catfish, crappie	1,000 fish
Dan Payne, Ashland, Oregon, Catfish	60 fish
Oregon Chamber of Commerce, Oregon, Catfish	?
Golden Trout Club, Lone Pine, Crappie	36 cans
Yuba Fish and Game Association, Black bass, crappie	126 fish
El Centro Chamber of Commerce, Striped bass	140 cans
El Centro Chamber of Commerce, Striped bass	60,000 fish
Turlock reservoir, Catfish	

A can carries from four to eight large adult fish, according to the size of the can and the fish. A can's quota of small fish is from 40 to 100.

The rescue and distribution of the game and food fishes is one of, if not the most forward conservation measures accomplished by the Department of Natural Resources. The value of the food supply, the pleasure afforded to men, women and children in their pursuit, cannot be estimated in dollars. All of the spinous fishes are the equal, if not more delicious as a pan fish, than trout. They are available to those who are unable to go to the mountain streams for trout.

In addition to rescue work, I am making an analysis of the stomach contents of the spiny-rayed fishes in an effort to learn which of the species are most predatory. Also particular attention is given to the range of the spawning season. This will enable us to determine the right season in which to take them. A record of overflowed lands, fed from waters that contain edible fish is kept. Also a record of all fish



PLATE XI. Shad, *Alosa sapidissima*.

from each body of water, where and when taken, their disposition, and the name of the owner or lessee of such lands.

In addition to the rescue work, 1556 small-mouth black bass fry and eight adult bass were secured from the Salt Spring, Reservoir, Calaveras County, and placed in the Citrus Grove pond near Oroville as a propagating pond for that species of bass.

The one rescue of most importance to the sportsman angler was the rescue from Concow Creek, Butte County, below the dam, of 500 adult rainbow trout of four pounds each, 100 of three pounds, 1400 of two pounds and 435 yearlings, makings a total of 2435 trout, weighing approximately 5208 pounds. This was accomplished with the assistance of the local deputy, A. J. Stanley, fourteen volunteers from Oroville and Chico and the rescue force from Sacramento. The Bureau was aided by several market fishermen, who gave valuable assistance by the use of their large nets, boats and crews and in return were permitted to keep the rough fish, pike and hardheads, as there is very little, or no, demand for them except by the Chinese. These men, together with the volunteer sportsmen, were the means of saving 141,313 game fishes, nearly all of which were adults or breeders.

I trust that it is in order to thank all those farmers who allowed us the freedom of their lands and those who notified us of the necessity of saving many fish. Also, thanks are due to the chief of the Bureau of Fish Culture for making it possible for such wide distribution and prompt delivery by our distributing car and the skillful handling of the fish. Also to the many deputies who have given fine cooperation, both in assistance and by correspondence.

MEXICAN CABRILLA AND GROUPERS ¹

By LIONEL A. WALFORD

Each year since 1927, during the late autumn, winter and spring months, an increasing number of large, unfamiliar seabass has been imported from south of California. Although there are at least four different but closely related kinds of these fish, they have so far all been reported to the Division of Fish and Game by dealers as "Cabrilla." The buying public, however, and retail marketmen are not always willing to experiment with strange, unknown fish, and it has been necessary for wholesalers to invent seductive names like *golden bass*. Since these excellent fish are deserving of more dignified treatment and need no apology in the form of sugar-coated names, this opportunity is taken of formally introducing them by their official common names: the *groupers* and the *Mexican cabrilla*.

The sea-bass family (Serranidae), to which these fish belong, is represented in California by four species: The black sea-bass (*Stereolepis gigas*), which resembles the groupers not only in shape and color, but also in the great size which it attains; and three smaller kinds, the rock bass, (*Paralabrax nebulifer*), the kelp bass (*Paralabrax clathratus*), and the spotted rock bass (*Paralabrax maculatofasciatus*) which looks like the cabrilla in color. On the Atlantic coast and on the Gulf of Mexico, the groupers, jew-fishes and hinds resemble very closely their Pacific coast relatives, and are esteemed not only as food but are famous as game fish.

¹Contribution No. 105 from the California State Fisheries Laboratory August, 1930.
2-81627

The sea-basses, an unspecialized group of fishes, are very difficult to describe for they have no clearly distinguishing characters. The ventral fins are attached below the pectoral fins; there is no bony support extending from the lower part of the eye across the cheek just under the skin; there are teeth in the center of the roof of the mouth; the dorsal fin is composed of spines as well as soft rays; the upper edge of the maxillary bone (the upper bone which forms the upper jaw) is exposed when the mouth is closed.

Of the Mexican forms which have been brought into California there are two types which may be easily recognized: One, the Mexican cabrilla, a closely spotted form comprising so far as we now know one species, *Epinephelus analogus*; the other type, the groupers, plain, dark-colored, obscurely or not at all spotted, including at least three species of the genus *Mycteroperca*. In this group, one species, the broom-tailed grouper (*Mycteroperca xenarcha*) can be readily distinguished by a toothed tail fin as contrasted to the even tail fins of the other species.

There are then these three names to apply to the large Mexican sea-bass: Mexican cabrilla, broom-tailed grouper, and grouper.



FIG. 10. The Mexican Cabrilla, *Epinephelus analogus*.

Mexican Cabrilla (*Epinephelus analogus*)

Distinguishing characters: The single dorsal fin, with usually 10 spines and from 16 to 18 soft rays; the spines being scarcely if at all higher than the soft rays, no one of them being noticeably higher than all of the rest; the anal fin having 3 spines and usually 8 soft rays; the teeth behind the outside row capable of being bent backwards. *Color:* Various shades of brown, the body being everywhere covered with small round dark spots; the sides with 5 or 6 faint dark cross-bars. Attains a weight of over 14 pounds. (See fig. 10.)

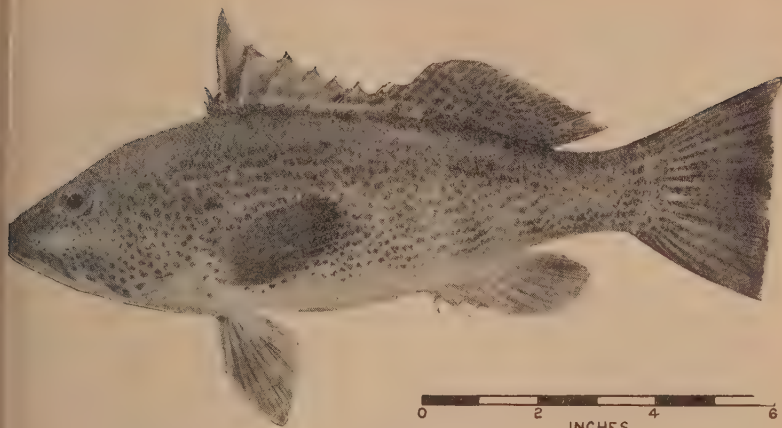


FIG. 11. The Spotted Rock Bass, *Paralabrax maculatofasciatus*, may at first glance be mistaken for the Mexican Cabrilla. (See Fig. 10.)

The spotted rock bass (see fig. 11), which is often taken in California waters, is a much smaller fish, and is easily distinguished from the Mexican cabrilla by the very high third spine of the dorsal fin, which is much over twice as high as the second spine, and higher than the fourth.

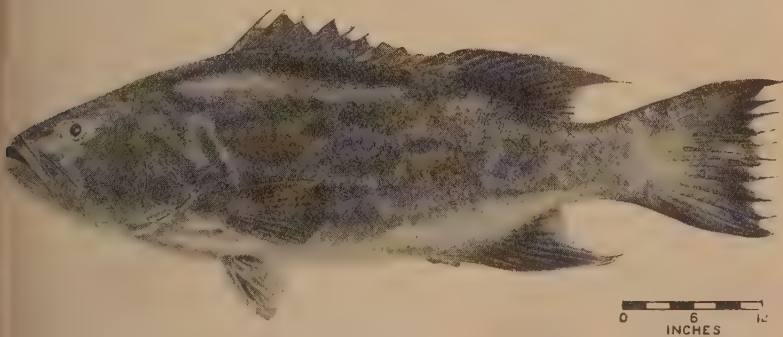


FIG. 12. The Broom-Tailed Grouper, *Mycteroperca xenarcha*.

Broom-Tailed Grouper (*Mycteroperca xenarcha*)

Distinguishing characters: The tenth soft ray of the dorsal fin, and the seventh soft ray of the anal fin are longer than the other rays, giving to the fins an angular appearance. In young specimens, the tail fin is perfectly even, but in older individuals, it becomes toothed as in the illustration (see fig. 12). **Color:** Light brown, the sides with obscure, large oval and oblong spots. Attains a weight of over 50 pounds.

GROUPE

Into this category may be placed those two or three species of seabass which have no distinguishing features on which to base quick identification. There is an absence of sharply contrasted color mark-

ings such as spots; the tail is perfectly even, not toothed; the soft part of the dorsal fin is rather even, not angular; the anal fin is highest in front. The color is brownish or grayish. These fish attain a weight of over 50 pounds.

If the trend of the total catch of these fishes continues to rise at the same rate as it has in the past few years, the cabrilla and grouper will become another great source of supply to our winter markets.

THE STATUS OF THE CANADA GOOSE IN CALIFORNIA

By JAMES MOFFITT

The Canada goose, known scientifically as *Branta canadensis canadensis*, is probably better known to the hunters of this state as the "Honker." It is the largest of all wild geese, individuals attaining a length of 43 inches from bill to tail tips and a wingspread of nearly six feet. The honker is exclusively a North American bird, not being known to occur in the wild on any other continent. It ranges over most of the United States and Canada and in winter occasionally visits Mexico.



FIG. 13. A pair of Canada geese and their young. Lassen County, California. Photo by E. S. Cheney, May, 1929.

The Canada goose is the largest of a group or species of four geese inhabiting North America. The other three subspecies are: The white-cheeked goose (*Branta canadensis occidentalis*) breeding in southeastern Alaska, wintering little if any south of its breeding range and unknown from California; the Hutchins goose (*Branta canadensis hutchinsi*) breeding along the Arctic coast from northern Alaska east

to Baffin Land and wintering abundantly in California and the Mississippi delta region; and the Cackling goose (*Branta canadensis minima*), which breeds on the Bering Sea coast of Alaska and on the Aleutian Islands, it winters practically exclusively in the Sacramento and San Joaquin valleys of this state. There is little likelihood of a hunter confusing the Canada goose with the cackling goose or little brant which weighs no more than a mallard duck; but is marked similarly to the honker. However, the Hutchins goose or big brant more closely approximates the honker in size and I have often heard them erroneously called Canada geese by shooters.

The general coloration of the honker is so well known to most hunters that a description of its plumage seems unnecessary. However, certain plumage characteristics might be mentioned that serve to distinguish it from its smaller relative the Hutchins goose. The true Canada goose is usually very pale creamy buff, nearly white, on the breast and undersurface. This pale coloration beneath commences abruptly behind the black neck and continues to the belly where it merges into pure white. Hutchins geese are generally much darker grayish buff or gray beneath. There is no abrupt contrast between the black neck and grayish undersurface in this subspecies; but the black merges into the lighter colored under plumage, which continues further to the rear in this bird, where it abruptly meets the white of the belly. Size, voice, method of flight and habits will better serve to distinguish the honker from the big brant in the field, as these plumage characters are difficult to observe unless the bird is in hand.

There has been much speculation and I believe not a little exaggeration on the part of hunters regarding the weights attained by the Canada goose. I have personally weighed a number of Canada geese scaling twelve pounds and consider ten to twelve pounds the average for fat males and eight to ten pounds usual for well conditioned females. However, I have heard so many reliable hunters claim to have weighed Canada geese scaling sixteen or even eighteen pounds, I believe it probable that exceptionally large and old males attain this weight. I have heard claims running as high as twenty-one pounds, which certainly must be exaggerations when it is considered that a very large swan weighs about eighteen pounds. Hutchins geese only bulk about half the size of honkers. Old males weigh from five to six pounds and females from four to five. Their length varies from twenty-six to thirty-four inches while a honker is seldom less than thirty-six inches in length.

The voice of a honker is a full, slow, deep throated U-Lunk—Lunk—Lunk or Lonk—Wha-Lonk. The big brant calls at a much higher pitch and the notes are uttered more rapidly as: Lank-Lank-Lank or A-Lank-A-Lank.

Honkers fly with slow, measured wing beats and are generally to be found in rather small bands of say from six or ten to twenty or thirty birds; Hutchins geese more frequently travel in large flocks and fly with quicker wing beats. The longer neck of the Canada goose, together with its slow wing beats, when once seen, will forever serve to distinguish it from the shorter necked and quicker flapping big brant. When standing on the ground or at rest on the water the proportionately longer neck of the honker is also distinctive.

Canada geese nest further south than any of our other North American geese. Their breeding range extends from east central California eastward through Nevada, northern Utah and Colorado to Indiana, then northward through the interior of the continent to the lower Yukon Valley, Alaska, east along the northern limit of trees to Mackenzie and Keewatin territories of Canada, Labrador, Newfoundland and Gulf of St. Lawrence. Honkers breed commonly throughout the elevated lakes of Lassen and Modoc counties, California, in the vicinity of Lake Almanor, Plumas County, and south to Lake Tahoe, El Dorado County.

The writer is quite familiar with the occurrence of the Canada goose at Lake Tahoe where individuals seem to be present the year around. Whether the birds that breed there remain throughout the winter or migrate out in fall to be replaced by winter visitant birds from the north, is a question yet to be answered; but this would seem to be the



FIG. 14. Rowlands Marsh, Lake Tahoe, California. A nesting ground of the Canada goose. Photo by Author, May 30, 1920.

case. Honkers formerly bred on a small island in Emerald Bay, Lake Tahoe, but have long since deserted this spot. Now their only breeding ground in this region is the marsh situated at the extreme southern end of the lake between Tallac and Bijou.

The geese repair to this marsh to breed each spring arriving in late March or early April. If the swamp is still frozen over on their arrival they forage along the open sandy beach of the adjoining lake shore until the marsh thaws out. When the writer visited this marsh on April 21, 1927, it had thawed considerably, although the winter had been a heavy one, considerable open water existed and dead tule of the preceding season were standing in open water in spots, though most of the marsh was still covered with two feet of snow. Only one pair of Canada geese was noted, though others were undoubtedly present and nesting at this time, for on a latter visit to the same spot on May 15, five pair were seen and two small young ones, about a week old

were caught on May 17. This indicates that eggs must have been deposited by April 10. The writer flushed a female from a late nest containing four fresh eggs on May 30, 1920. (See photo.) Ordinarily the honkers of Tahoe have large young by this date as is attested by one of the size of a mallard I captured there May 29, 1921.

Formerly inhabitants of the region collected numerous Canada goose eggs each spring which they hatched out under hens. It was told that in most cases the young were successfully and easily reared to become as tame as barnyard fowl. More active policing of this marsh in recent years has apparently stopped this practice and the geese are fortunately now unmolested by man during the breeding season. That other enemies occasionally account for some of them was indicated to me on June 4, 1923, when I found a nest containing six addled eggs of this goose with the remains of one of the parent birds six feet away,



FIG. 15. Nest of Canada goose, Rowlands Marsh, Lake Tahoe, California. Photo by Author, May 30, 1920.

devoured except for head, wings and tail. Scrutiny of dry mud surrounding the nest revealed old coyote tracks and solved the identity of the marauder.

The young of the Canada geese at Lake Tahoe begin to feather out and reach the "flapper" stage about July first. The adults then commence to loose their flight feathers, which are moulted all at once, rendering the birds flightless for a short interval. During this time the old birds and the young ones, which have not yet grown their wing quills, spend practically all the time either in or immediately adjacent to heavy tule patches, where they may readily hide and are almost impossible to apprehend. August finds both old and young gaining the power of flight and towards the latter part of this month the young

have lost all traces of the downy plumage and are fully feathered in the first true plumage. Subsequent to losing their flight feathers the old birds have a complete plumage moult and appear in an entire dress of new feathers by mid-September.

I am not certain whether the geese then move out to other feeding grounds or remain in the vicinity of the marsh. Certainly they do not immediately come west to the wintering grounds in the Sacramento and San Joaquin valleys, where they are unknown before November. However, an experience I had while deer hunting near Twin Peaks, Placer County, (just five miles west of Lake Tahoe) on September 1, 1918, leads me to believe the geese move to other feeding grounds about this time. I was then hunting at 9000 feet elevation in a thick fog or clouds, near the summit of the Sierran divide when I heard, not high overhead, the unmistakable notes of a flock of Canada geese. Certainly no geese, unless migrating, would have been flying so far from water at this elevation in such weather.

A visit to the marsh at Lake Tahoe, October 18, 1924, failed to reveal any geese. However, three were noted there on October 13, 1925, and twenty on October 23 of the same year, when one was shot. This increase in numbers as the season lengthens seems to indicate that the birds were working into the region, rather than to have been local bred birds. October 15, 1926, eight honkers were seen on this marsh.

I spent the winter of 1926 to 1927 at Lake Tahoe and only saw four Canada geese there the entire time. These were noted on the Truckee River, four miles below Lake Tahoe, January 4, 1927. Residents told me they were formerly quite common on this river, especially in very cold weather, where they sometimes remained a month. On January 1, 1928, I saw eight birds feeding on a grassy point in Lake Tahoe two miles north of Tahoe City. Residents claim the birds are often present along the lake shore all winter, feeding on the sandy beaches and points.

The Canada geese winter in a variety of localities throughout northern California and more sparingly at suitable points in southern California south to San Diego. Small lakes in the Sierran foothills or coast ranges are favorite wintering resorts for honkers from which they fly by day to adjoining fields to feed. Many are known to winter on East Park Reservoir, Colusa County, whence they forage west into the grain fields of that county. Two or three hundred of these birds ordinarily winter on the Spring Valley Lakes of San Mateo County, and every lake or reservoir of any size in northern California is a potential wintering ground for this bird if protection is afforded them. The honker is not abundant, in the sense that other geese are, in any part of its winter range, as it does not band up in such large aggregations, but prefers to scatter out over the country in smaller companies. In fact where other geese are most numerous, the Canada goose is usually found in fewest numbers. This applies to the great goose wintering grounds around Willows and Colusa and the Los Banos Country where white, white-fronted, hutchins and cackling geese are so numerous and honkers are usually conspicuous by their absence.

Probably the greatest wintering ground for honkers in this state is the territory south of Dixon and Davis in Salano and Yolo Counties to the Sacramento River and west to include the Suisun marsh region.

I am told a very large number of these birds winter northeast of Marysville towards the Sierran foothills. In the San Joaquin Valley the birds are fairly numerous, particularly on the extreme western side toward the coast ranges. A considerable number winters on Butte Creek in the vicinity of the Marysville Buttes. It is rare on San Francisco and San Pablo bays except at Tubbs Island, Sonoma County, where it is present each winter. The Canada goose is only an occasional visitor to salt water, and is rare on Tomales and Humboldt bays.

Although it breeds further south than any of our other North American geese, the Canada goose is the last species of goose to reach the wintering grounds in our state in the fall. It also winters at higher elevations than the other geese and seems able to withstand more cold



FIG. 16. Canada goose nesting on a snag, Lake Almanor, Plumas County, California. Enlargement from motion picture, "Geese of California." Photo by E. S. Cheney, May, 1929.

than its northerly breeding relatives. Lyman Belding, who made many careful notes on goose migrations in the Sacramento and San Joaquin valleys in the early "eighties," writes in his manuscript now preserved in the Bancroft Library of the University of California that the first honkers were noted near Stockton, November 11, 1880, November 23, 1881, and December 2, 1885. The earliest fall birds I have noted in central California was a flock of four that lit near my "speckled-belly" decoys, five miles southeast of Colusa on November 2, 1929. Howell Joseph, a Willows goose hunter and a thoroughly competent observer, told me he saw several Canada geese near Orland, Glenn County, on October 28, 1929. I saw my first honkers on Suisun Bay

the fall of 1929 on November 17, though Mr. H. H. Magee assured me he had seen a flock of over fifty birds there two weeks earlier. The first I have noted this fall (1930) on Suisun Bay were seen November 19, a flock of 20 birds.

The numbers of Canada geese wintering in our central valleys seem to vary considerably from year to year and their abundance here is apparently dependent upon the severity of the winter. For instance the winter of 1928 to 1929 was unusually cold and residents of Willows and Colusa assured me that more honkers were present in these districts that winter than for any of the preceding ten seasons. This assertion seems quite logical when it is recalled that many Canada geese spend the winter on our higher lakes, unless the weather be so severe as to freeze them up, when they must retreat to lower elevations.

In addition to being the latest arrivals in the fall the Canada geese are also the first geese to depart in the spring. The movement from the wintering to the breeding grounds may start as early as the latter part of February in central California and is in full swing throughout March. By the end of March most of the honkers have already left their winter ranges, while the Hutchins, cackling and white geese are fully a month later in migrating and the white-fronted or speckled-bellies do not leave until late April or early May. Belding noted a flock crossing the Sierras over Murphy's, Calaveras County, February 22, 1887. Mr. D. D. McLean saw the first easterly migrants crossing the Sierras over his home near Coulterville, Mariposa County, on April 4, 1921, and remarked that the birds were unusually late that season. The latest flock I have noted in the Sacramento Valley consisted of more than 200 birds seen along the Sacramento Valley west of West Butte, Sutter County, February 16, 1929.

The Canada goose suffered great decimation at the hands of market hunters in California prior to the passage of the Federal Migratory Bird Treaty Act in 1916 which prohibited the sale of waterfowl. Old-time hunters tell of the great numbers of honkers to be seen "in the old days." However, on account of its more widespread winter habits, less gregarious ways and extreme wariness, it is probable a much smaller percentage of Canada geese were killed than geese of the smaller varieties. From the end of November, when honkers have arrived at their winter quarters in numbers, until the end of the shooting season sufficient of these fine birds are now present in most parts of northern California to afford good sport to the hunter. However, in order to have any luck at all in hunting this goose the shooter must have a thorough knowledge of its habits, for it is probably the warier of our waterfowl. Indeed, the expression "silly as a goose" is in many ways applicable to the honker, or any other wild goose I have ever met for that matter.

With the present bag limit on honkers at four birds a day and eight a week and thousands of acres of grain stubble available for winter feeding grounds, there seems little reason to fear that this fine bird will not continue to visit us in numbers each winter for a long time to come. The most vital need of the Canada goose in California at the present time is assurance that the lakes which form its breeding grounds in the northeastern part of this state be kept intact.

THE MOUNTAIN SHEEP OF CALIFORNIA

By E. H. OBER

Inyo County is bounded on the east by the Nevada line, on the west by the crest of the Sierra Nevada Mountains. For its southern boundaries it has Kern and San Bernardino, and to the north Mono County. Its latitude checks up with that of Virginia and Kentucky, and its area of 10,294 square miles makes it the second largest county of Cali-



FIG. 17. Supreme as rock-climbers, desert mountain sheep are at home on the highest crags and peaks. Photo by E. S. Cheney, Inyo Mountains, Inyo County, California, October, 1929.

fornia. The county can be spoken of as being somewhat unique. No other county in the United States presents such a varied surface in view of the fact of its having the highest peak, Mount Whitney, (14,502 feet elevation) and the lowest depression, Death Valley, (over 300 feet below the sea). Its surface is largely mountainous, interspersed with valleys, of which the Owens Valley is the largest, being over 100 miles long and in the northern portion 20 miles wide, and somewhat varying in width as one goes south, the Sierra here being impassable by wagon

or motor car. The valley is reached from the north or south only from California points.

The altitude of Owens Valley ranges from 3620 feet at Keeler, the southern end, to 4148 feet at Bishop, the northern end. Mount Whitney is, as has been stated, within the boundaries of Inyo County and many slightly less high neighboring summits afford scenic views scarcely less grand. Death Valley, one of the very lowest depressions in the United States is remarkable for the following facts: On each side of the valley mountains rise to an altitude of ten and eleven thousand feet, and a temperature of 120 degrees is not at all rare; people as a rule, and somewhat as a whole, are quick to accept the function of the valley as that of Creation's morgue and where desolation reigns supreme. However, north east, south and west of the main floor of the valley, and almost at its very heart, springs of pure cold water are to be found. This holds true throughout all of the mountain ranges bordering Death Valley. Furnace Creek ranch is located directly on the floor of the valley, and to the north comes Saline, Grapevine, Eureka, Cowhorn and Deep Springs valleys, and to the west Panamint Valley, all of which are located in Inyo County.

Writers of note have often referred to Inyo County as a sportsman's paradise, and have maintained that the Sierra Nevada mountains, particularly their frontage west of Owens Valley, together with those rare and silent mountains of Death Valley are, from a unique and scenic standpoint, unsurpassed by any other portion of the globe.

The county, as a whole, is extremely well supplied with game and game fish, and has the distinction of having within its boundaries 55 per cent of all the mountain sheep contained in California.

The origin of our American mountain sheep, it would seem highly probable, was by immigration from the Old World. The writer has given much time and thought to this subject and has found much evidence to substantiate this view. It would be quite reasonable to figure out that the North American sheep came in a roundabout way across Behring Straits' ice pack ages ago, and are really descendants of the Central Asia sheep, which are known as the Marco Polo and Argali, both of which roam the rugged mountains of western Mongolia. The two species are quite distinct, the Marco Polo is recognized by its wide spreading horns and the Argali by the large circumference of its horns at the base. According to Dr. W. T. Hornaday, as the sheep spread to the southward they produced the rather small Urial and Burrhel sheep, but that all stopped short at the northern edge of the superheated plains of India, while to the northward their fate was very different.

Continuing a little further regarding the sheep of the far north and their relationship, it would seem quite reasonable to presume that those of Alaska and those on farther north were the Marco Polo type, which would include the white sheep, *Ovis dalli* and the *Ovis fannini* and the so-called black sheep, *Ovis stonei*. All can be distinguished by their wide spreading horns from tip to tip, and their comparatively small circumference measurement at the base of horns. Fifteen inches seems to be a fair size at base of horn for the black or stone sheep, and a tip to tip measurement of forty inches. Any white sheep around the Kenai peninsula, Alaska, can be considered to be a good specimen

that measures thirteen or fourteen inches base measurement and a tip to tip measurement of twenty-eight or twenty-nine inches. Correspondingly all of the sheep that migrated to the south check up with the second species from the Old World, called *Ovis ammon*, which have large base horn measurements and small tip to tip measurements. Rocky Mountain sheep, in rare specimens, have measured seventeen inches at horn base with a tip to tip measurement of seventeen inches. The Argali sheep of Central Asia have in rare adult specimens a horn base measurement of nineteen or twenty inches. Those of the Marco Polo, in the same locality, have horn measurement at base of fifteen or fifteen-and-a-half, with a tip to tip measurement of thirty-nine or forty inches.

As has been said, North America contains seven or eight so-called species of mountain sheep, which we are told form two fairly distinct branches of the genus *Ovis*. The big horn of the Canadian Rockies forms the stem of the first, and from it branches the Nelson and Mexico sheep. The stem of the other branch is found in the black and white sheep of the far north.

To this writer it has always seemed strange that where the ranges of the big horn of the Canadian Rockies and the so-called "black sheep" came together, the so-called Fannins sheep seem only as a form standing between the white and black so-called species. The white sheep, however, have an immense range, covering half of Alaska and practically the whole Yukon territory, as has also the Mexico sheep, which can be found in many mountain ranges throughout Mexico, including the mountains in the immediate vicinity of Santa Maria Lakes in Chihuahua, and southward to the lower end of the Lower California peninsula.

From northern British Columbia and Alaska to northern Mexico there was formerly a practically unbroken range of mountain sheep for 3600 miles. Scientists have reported finding several species of mountain sheep in this broken range, all of which have been described since 1883. Of all the so-called species only three or four are sufficiently interesting to observe separate mention in this paper. The first, the largest and most widely known of these sheep in America, is the big horn of the Canadian Rockies, known to science as *Ovis canadensis*. The writer has always thought, and still believes, that the so-called Nelson Death Valley sheep (*Ovis nelsoni*), including also the "Mexico sheep" (*Ovis mexicanus*) are really the variants of the big horn sheep from the Rockies, as it is very reasonable to presume that in the long span of years this stock migrated from the Canadian Rockies as far south as the northern states of Mexico. But as they came south, various climatic and geographic conditions were met. As a matter of fact the environments of the localities where the sheep have made their homes for years have necessarily had all to do with their size and form. This fact is particularly exemplified in the Death Valley sheep.

It seems reasonable to believe that all of the sheep which migrated to the south, including Death Valley and Mexican sheep, are the same, under geographic changes. We must also note that the three sheep look alike, comparatively speaking; all have large horns at base measurements, and above all rather narrow horns from tip to tip; all have about the same build of body and the peculiar white or cream

patch on the hind quarters completely surrounding the short tail. The Rocky Mountain sheep will, of course, always outmeasure the Death Valley or Mexican sheep when the tape is used. This is due, I am sure, to different food and water conditions embracing their chosen habitats.

There are numbers of Death Valley and Nevada, or Mexican, sheep that can compare favorably in horn measurements with the Canadian Rocky Mountain sheep. A big horn of the north can be considered good that will measure $16\frac{1}{2}$ inches basal circumference. That measurement would be practically the maximum for California or Mexican sheep. I have heard, from time to time, all sorts of stories concerning 17 or 18 inch horn measurements for California or Mexican sheep, but they are few and far between. I doubt very much if there can be produced, living or dead, a California sheep with horns which will measure $18\frac{1}{4}$ inches at base of skull, particularly if the horns are one



FIG. 18. Mountain sheep ascend and descend the steepest canyons, crossing with ease the most perilous passes. Here a group of ewes with young are entering a steep canyon. White Mountains, Inyo County, California. Photo by Robert Symons, March 21, 1930.

or more years old. It must be remembered that all sheep horns shrink in circumference with age. A large horn will, in two years drying, shrink nearly an inch in basal circumference and there seems no way to prevent it in a mounted specimen. The largest mountain sheep horns contained in North America come from British Columbia and southwestern Alberta and are from the true Rocky Mountain big horn now *Ovis canadensis*, but for nearly ninety years called *Ovis montana*. A record head of any big game animal is not necessarily the largest head that can be found; usually it is an impossibility to find the finest head of any given species. So many qualities enter in for judgment that it is almost impossible for any one specimen to combine all of them.

I have read with interest the published report by Allen (1912) which deals with the nomenclature of the North American mountain sheep. He revives the old name *Ovis californianus* of Douglas for a hypothetical race "formerly inhabiting" the "Cascade Mountains of southern Washington and Oregon and Mount Shasta and the mountainous country to the eastward in northern California" and "now probably extinct." He establishes "Mount Adams, Yakima County, Washington," as the type locality of *Ovis cervina californiana*.

Joseph Grinnell (1912) in his report on "The Big Horn of the Sierra Nevada" says "The existence of the distinct race, with the above range, for which the name *californiana* is useable, is suggested by Allen, thus wholly on geographical grounds." On the same grounds Grinnell would point out the probability of the former existence of



FIG. 19. When motionless, desert mountain sheep are difficult to discover. Inyo Mountains, Inyo County. Photo by E. S. Cheney, October, 1929.

separate races in the Cascades and in the Sierra Nevada. He claims it would appear illogical to assume that the Sierra Nevada form is identical with that of Washington. To this writer, also, it would seem quite logical to assume that the sheep described by Allen from Washington came perhaps as far south as Mount Shasta, but no farther. The sheep described by Grinnell from the Sierra Nevada Mountains differ from those from the Panamint Range of mountains bordering Death Valley. The Sierra sheep are, quite naturally, considerably lighter in color than the desert form, due to geographic conditions.

Old timers maintain that before the advent of the white man in Owens Valley mountain sheep crossed and recrossed Owens Valley

from the Death Valley ranges to the Sierra in several places south of Big Pine. As time rolled on the progress of civilization and the works of man in the valley seemed to check these migrations. For the past sixty years I have never heard of a mountain sheep making the crossing. Not so, however, with our mule deer. To this day the deer perform, as of old, crossing at various points throughout Owens Valley during the late fall, and recrossing to the Sierra in the early spring. Of late years, however, many deer have wintered in the lower portions of the Sierra, west of the Owens Valley proper.

The difference in form of the Sierra and Desert Mountain sheep is due to their environment. The Sierra sheep hug the snow line at all times of the year, and as a consequence have been supplied by nature with a heavy pelage. These high Sierra sheep perhaps have never migrated further to the north than Mount Ritter or Banner. They have reared their young as best they could and now their numbers have reached about two hundred head. Scattered locally, their range extends from Convict Lakes Mountains, Mono County, to northeastern Kern County. Mount Tom, directly west of Round Valley particularly the eastern slope, holds upwards of thirty-five head at all times of the year. Most of the others are found around Mount Baxter saw mill and Oak Creek passes west of Independence, Inyo County. The crest of the Sierra Nevada Mountains thus forms the Western boundary of the present range of the mountain sheep in California.

Mount Montgomery, in the White Mountains, forms the northern boundary of the Desert Mountain sheep. This variety can be found here and there southward throughout the White Mountains. They may almost always be found around White Mountain Peak and its immediate vicinity to the north, and Deep Springs Home Stake Canyon, Piute Monument, Beverage Mountains, Wacoba Mountain, Lea Canyon, head of Willow Creek, Saline Valley Mountains and on down as far as Cerro Gordo to the south. They range to the east in nearly every mountain range throughout the Death Valley Section to the Nevada line.

In southern California, Mount Baldy and Cucamonga Peak have small remnant herds and Old Grayback Mountain, it may be said contains just a small number over the remnant stage. The San Jacinto Mountains contain sheep west of Palm Springs and around what is known as Borago Valley sections, and to the south sparingly in the range to Campo, on the Mexican line. The mountains to the east and north of Imperial Valley, together with those of Riverside and San Bernardino counties, east to the Colorado River contain mountain sheep in the remote and extreme sections. San Bernardino County has the distinction of having, in the mountains to the north and east, the second largest number of mountain sheep in California.

If all of the mountain sheep contained in California could be gathered together and a careful and accurate check could be made on the numbers, I am of the honest opinion such would not reach 3,000 head, as it must be understood that sheep are few and very much scattered throughout the mountain ranges, regardless of the statements of those who claim thousands of sheep for California. Such statements usually come from people who are not accurately informed and who are usually ever ready to jump at conclusions.

There seems to be now just about as many mountain sheep in California as there were thirty or forty years ago, and in the opinion of this writer, their numbers will continue to be about the same from year to year.

No wild animal other than the mountain sheep has circling horns. Large rams are readily recognized by their massive round, curving horns, which in profile describe from one-half to three-fourths, or more, of a circle, and which are never shed. The ewes have horns which are erect and flat and usually about nine or ten inches long on adult specimens. Mountain sheep do little migrating from rough and steep sections to lower or rolling hills, contenting themselves with the higher elevations no matter what the weather conditions may be. However, Death Valley sheep are known to have crossed Owens Valley and



FIG. 20. Desert mountain sheep travel through inaccessible country with wonderful reserve of strength. Inyo Mountains, Inyo County. Photo by E. S. Cheney.

others of the state sometimes cross other valleys from one range to another. The ram mountain sheep is, as a rule, much darker in color than the ewe. The average life of a mountain sheep reaches about seventeen years. Their age is reckoned by their teeth, and their span of life is determined by their range conditions. Their round, thick, and comparatively short body is covered with practically the same pelage as that of a mule deer. Some writers and nature fakirs have given the public the impression that wild mountain sheep are covered with wool, which is quite wrong. The hide of a mountain sheep in no way whatever resembles the wool pelt of the domestic sheep. Mountain sheep are very much like the domestic sheep in their feeding habits, but must not be confused as being similar in any other way.

These animals, like deer, gather in large herds during their rutting season. In California rutting season begins in October and sometimes lasts over into November. As soon as this season is over the sheep disband, the large rams scatter everywhere, and the ewes, yearlings, and the two and three year old sheep remain in bunches throughout their respective ranges.

Large rams, in the rutting season, indulge in some great combats. Two rival rams will usually choose, as near as possible, a level spot, back off ten or twelve feet from each other then come together with the impact of a heavy sledge hammer. The force of the collision sometimes throws both sheep upright on their hind legs. The combat never lasts very long, two or three lunges as a rule ends the fight. While I have never witnessed a complete "knockout," I have seen on two occasions "technical knockouts." The loser usually runs away at top speed after he has given up the battle. Rams never break their horn tips in fighting, as many sportsmen and naturalists have hastily concluded they do. Coming together head on, it would be a physical impossibility for the tips to be harmed. Nearly all of the older rams of Death Valley, and California desert mountain regions have the ends of their horns broken off. This is due to their use as prys among the rocks while they are in search of certain succulent bulbs and roots eaten during the seasons of drought, a favorite is desert or matilija poppy roots, which are greatly sought after by the sheep in all of the Death Valley mountains.

Likewise, all of the desert mountain sheep ewes have more or less tender feet (if observed when not alarmed) due to their digging for bulbs. Apparently this food seems to serve as a thirst quencher until rain falls and the various remote springs are replenished. The Sierra mountain sheep, on the other hand, never have broken horn tips except by accident. They have at all times abundance of water and forage, and do not find it necessary to use their horns for prying rocks to unearth succulent roots.

Mountain sheep seldom come to water where green feed is in evidence. In all of the desert mountain ranges in the very hottest and driest months, (which are usually July, August and September) sheep come, if possible, to water twice a week, and sometimes more often, if not alarmed at their accustomed watering place. This habit depends, of course, on conditions and circumstances. Sheep can and do go a long time without water if necessary. The animals are very apt in securing and eating roots yielding moisture. They perform their longest migration when pressed too far by thirst. Sometime they are so famished for water that they will come in to the water holes drop on their knees when necessary, and drink for a minute or so without once looking up. Their usual custom, however, in drinking is to look up carefully and quickly every few seconds, their thought being perhaps, to survey their immediate surroundings for protective purposes.

Lambs of mountain sheep never come to water during the entire nursing period, which runs usually about four or five months. They are generally left high up on the mountain side, and their colors blend so perfectly with the rocks that it is like looking for a needle in a haystack to find them. The lambs while in their hidden position are nearly

motionless and extremely quiet until the return of their mothers from their upward and outward routes to their feeding and resting places.

There are watering places for mountain sheep in numerous localities throughout all of the desert ranges. A knowledge of these sometimes affords occasional unscrupulous and contemptible hunters the opportunity to lie in wait and indulge in indiscriminate killing. This is a very old custom and there seems to be every indication that the habit will continue in the future. In view of the tremendously large and remote areas over which these animals range, there are perhaps a thousand places where sheep can come to water and where killing can be indulged in. It is hoped that more of such law breakers will be apprehended and brought to justice, for they are depleting the number of our mountain sheep throughout the desert mountain ranges.

Mountain sheep are very playful, particularly the lambs and young rams and ewes. It is truly a great sight to see a herd of them, when in no way alarmed or suspicious, at play.

Bold and somewhat reckless climbers, they are capable of feats that really are astonishing. However, mountain sheep can not, and never did, or never will, alight upon their horns. When pressed or pursued they perform almost miraculous climbs, jumping here and there as they traverse the rocky ledges, always coming out all right, when to the observer it would seem certain that they would be dashed to death.

The young of all mountain sheep in California are born in May and June, and almost always two in number. The mothers, if possible, always pick out the most dangerous and inaccessible crags and precipices imaginable. Their idea, no doubt, is to have their offspring far beyond the reach of foes (other than the golden eagle). Another reason, I imagine, is to teach the young the first rudiments of negotiating steep and rough country. The lambs remain where born for a few days, or until such time as the degrees and variations of the mountainside have been properly figured out for mastery. The mothers with their young are exceedingly alert and watchful at all times. From their usually safe positions they can detect the coming of man or other enemy. All mountain sheep have one bad fault, that of curiosity, which holds them too long when approached by man. Once alarmed, however, they can disappear like magic over the points of the prominences they have been occupying. By the time the human reaches the spot where the sheep was standing the animal is usually out of sight.

The lambs of mountain sheep are able, at a very tender age, strange as it may seem, to follow their mothers down and through the very steepest cliffs and roughest country without the least difficulty.

When mountain sheep have been fired upon in steep or rough country and are once thoroughly alarmed, they will leave such sections and will go until other rough and steep country is found, whether it be two miles or twenty. All mountain sheep seem to thrive equally well under varied conditions. This is due wholly from their feeding on every growing plant and bush found in their domain. The usual conception of wild mountain sheep being inhabitants of the clear cold upper world is exactly right and justified, particularly in the case of the Rocky Mountain, Alaska or Sierra sheep, for in late spring or early autumn they seek the rugged high elevations where they remain

until the heavy winter snows drive them down to open and lower uplands.

Death Valley sheep thrive practically all winter, from top to bottom of the desert mountain ranges where they seem to be perfectly at home amid the cactus, yuccas, and other thorny vegetation where water is extremely scarce, and where the midsummer heat rises about 110 degrees Fahrenheit in the shade. The sheep seek, in the heat of the summer days, the sheer cliffs, and lie at their base, and venture out to feed very late in the afternoon and at daybreak. Old desert mountain sheep often can hardly hear a sound, owing to their very small ears being cemented up with desert ticks which start from the time of their birth. Their sight and scent, however, are exceptionally keen. In the spring and early summer, when the grasses and wild flowers are in profusion throughout the desert mountains, sheep travel but little.



FIG. 21. A fine picture of alertness is presented by this band of ewes with young of previous spring. White Mountains, Inyo County, California. Photo by Robert Symons, March 21, 1930.

As soon, however, as the green feed begins to dry, these animals are constantly on the move, going down over canyon and up another desert mountain. Sheep often go twenty miles for water then feed back to where they started.

The weight of an average California mountain sheep ram, depending on its condition, seldom goes over 140 pounds dressed. The head and horns on a large specimen runs about 31 or 32 pounds. The ewes are very much smaller in proportion. The writer has had much to do with weighing and measuring California sheep specimens. He has from time to time been collecting for scientific research. Under his supervision was collected the group of Death Valley mountain sheep which filled the gap of North America mammals now on exhibition in the Bronx Museum, New York.

The hoofs of mountain sheep are excellent for use as brakes in descending inclines that are very steep and smooth, and likewise for clinging in very steep and high country. They are somewhat long and narrow, hollow cupped, with sharp edges, and fitted inside, near the heel, with a soft, rubber-like substance, all of which seems to have been provided by nature for the convenience of these rare and elusive animals. Their form and shape in all their respective domains are the same. Those of all desert mountains are of a light steel gray and those of the Sierra Nevada mountains are of a very light pearl gray. Their eyes are not black in color, as recounted by some writers, but are dark yellow in hue, with the iris a straw color, a shade darker than Naples yellow.

There has been no open season on mountain sheep in California since 1883. To open a season would, in the opinion of this writer, be nothing less than a crime, and would be, and prove a step in the wrong direction. There are no men or set of men in California today who in or by any manner could particularly increase the supply of mountain sheep sufficiently for an open season. Taxidermists and perhaps others equally interested may take issue with these statements; nevertheless, such are the bare facts surrounding this situation.

Many factors govern the decrease or increase of California mountain sheep far beyond the control of man. These animals have a tremendously large mountain area to roam over which harbors many natural enemies. Always they are combating the destructive golden eagle. This large bird frequents all of the mountain sheep territory in California. The writer, after a lifetime of study and protection of the birds and animals of California's great resort region, has had the privilege of witnessing many strange and unexpected happenings which are seldom seen, but are part and parcel of events that fill the lives of nature's denizens of the desert. The most thrilling and interesting, in my opinion, was my presence in a "ringside" seat among the pinnacles of the Grape Vine mountains of Death Valley, there to witness the following drama of the wilds.

After a morning spent in reaching the summit of the range where a band of mountain sheep had been sighted the day before, we found "signs" and started stalking our game carefully, finally jumping and killing a fine large ram. My party was engaged at the time in securing specimens of the desert mountain sheep (*Ovis nelsoni*) for the great naturalist, Dr. Hornaday. The ram, along with a female sheep, were later placed in the Bronx Museum in New York, as above mentioned.

At the firing of our few shots, the rest of the band of sheep promptly scattered, jumping and running over trails that a man would not care to walk carefully over. One yearling sheep, confused and a bit inquisitive, became separated from the bunch and circled back and up toward where we were preparing our kill for transportation to camp. Sitting motionless we allowed the sheep to get within fifty yards of our position before he became aware of our presence. Upon sighting our party of three he wheeled and began a mad flight down the long sandy draw in which we had made our kill. Suddenly out of the sky came a thunderbolt of dark hue, the wind hissing through its wings; it shot straight down to deal the yearling a resounding blow

on the back. The sheep staggered by the blow kept gamely on. The golden eagle soared up for another attack, while its mate struck the yearling. Four times each great bird zoomed and struck, always in the same place. The sheep, badly wounded by the attacks, was plainly weakening. The final act came when the largest of the birds, the male, flew ahead of the sheep and alighting on the rocks in front of the animal beat its wings and screamed repeatedly in an effort to head the sheep off. The yearling, awed by the terrible figure of the killer, paused to seek a new exit; that pause was its doom. Straight and as fast as a bullet came the female bird, striking this time at an angle in order to get the sheep to fall. The angle was perfect, and the blow so hard that the badly weakened sheep fell sprawling down the draw. Both eagles pounced on the carcass, tearing madly at the choicer parts of the anatomy. Upon close examination we found that the killing



FIG. 22. Desert mountain sheep find nourishment in the sparse vegetation near the summit of desert mountains. They are partial to browse off various succulent bulbs and roots. Photo by E. S. Cheney.

blows were innumerable punctures by the birds sharp talons into the back over the kidneys, the sheep bleeding internally, scarcely a drop of blood being visible on the outside. In all my experience with the wild life of this section I have never witnessed such remarkable teamwork or such a parallel to human intelligence in making a kill.

Mountain sheep lambs are born late in May and early June, and at the very time young eagles are in the nest. The parent birds are wonderfully active in supplying their young eaglets with food, and unfortunately their favorite delicacy seems to be the young lambs of mountain sheep. The writer, in November, 1922, in company with two witnesses, discovered three golden eagles' nests in the Death Valley

and Panamint ranges. Upon careful investigation of the nests, their structure, position and locality, there were discovered five small mountain sheep lamb skulls, together with various other bones of desert rodents.

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CALIFORNIA SEAWEEDS

By PAUL BONNOT

The coast of California is rough and rocky, and the littoral zone, from a depth of ten fathoms to the level of high water, supports a rich marine flora. The larger forms of algae (kelp) are found in the deeper water, while in shallow water and between tide levels are the smaller forms (seaweed). The larger kelps are not numerous as to individual species, but they more than make up for this by forming vast beds, hundreds of square miles in area. Most of the seaweeds are not individually numerous but there are so many species that the rocks, uncovered at low water, can scarcely be seen through the dense growths they support.



FIG. 23. Carrying seaweed from the rocks to the drying fields on top of the bluffs. Chinese camp about five miles below Pigeon Point. *Porphyra* growing on the rock in the foreground. Photo by Paul Bonnot, May 17, 1929.

Very little commercial use has ever been made of this abundance of marine vegetation. California is a comparatively new country and there are many natural resources more easily exploited. During the World War there was flurry of activity in the utilization of the kelps. Products such as potash and iodine which had been previously imported, were not available. Balch (1902) discovered that the kelps were high in potassium salts, so that, with the foreign supply cut off experiments were begun on a large scale to determine the usability of the kelps. While the war lasted several concerns under government subsidy, harvested great quantities of kelp and produced the needed

chemicals, but with the end of the war the business gradually declined. It was found that on a peacetime basis the cost of production was prohibitive. However several efficient methods of production were worked out during this period and the kelp beds remain, at least a potential source of several necessary commodities awaiting cheaper methods of utilization, or the press of future necessity. At the present time there are two concerns using kelp in California. One of these produces chemicals and fertilizer, the other produces products which are marketed for human consumption, for stock feed and for fertilizer.



FIG. 24. Yuen Bon, collector of seaweed (*Porphyra*) at Pescadero. The seaweed is brought up to the drying place in the baskets and straining racks. Photo by Paul Bonnot, May, 1929.

Only four species of kelp have been used commercially in California. These four species are abundant, available and contain a high percentage of potassium. They are: *Macrocystis pyrifera*, *Nereocystis luetkeana*, *Pelagophycus porra* and *Alaria fistulosa*. *Macrocystis* and *Pelagophycus* are found from Point Sur southward. *Nereocystis* and *Alaria* occur from Point Sur northward. During the war the *Macrocystis* furnished the largest tonnage as it is the most abundant of the kelps. It is a perennial and grows rapidly. It can be cut four times a year without injury to the beds. It has been estimated that from Point Concepcion to the Mexican boundary there are approximately one hundred square miles of kelp beds which would yield, with two cuttings, 18,000,000 tons of wet kelp per year.

Agar agar is imported from Japan to the United States in large quantities. It is used extensively as a culture medium in bacteriological work, for sizing cloth and to make candy and fancy jellies. The



FIG. 25. An Indian camp on the highway a mile below Albion. Seaweed (*Porphyra*) drying in the sun. Photo by Paul Bonnot.

Japanese agar is made from various species of *Gelidium*, *Graciliara* and *Eucheuma*. There are eight species of algae from which the Japanese can produce agar. On the coast of southern California there are fifteen species of algae which are suitable for the manufacture of agar. Some of these would no doubt furnish an inferior article, but several are identical with the Japanese species. There is at present one company in California producing agar from local and imported seaweed. They are marketing, besides the commercial agar, jellies, breakfast foods and candies.

As a food for human consumption seaweeds have long been in use in various parts of the world. The Chinese and Japanese are the principal users today. In Japan, where an increasing population runs a continually losing race with the food supply, various forms of algae are cultivated. The Chinese use a great deal of seaweed and for the last forty years have gathered seaweed on the California coast for

export to China. The only local seaweed utilized directly as human food to-day is *Porphyra perforata*. This species is found on the Pacific coast from the state of Washington to Mexico. It grows on the rocks to the limit of high water. It is an annual, the young plants appearing before the old ones die. After the heavy winter storms only a few specimens can be found in the most sheltered places. With the arrival of spring and more congenial weather it quickly spreads and by April it covers the rocks in favorable places in dense mats. It furnishes food for the abalone (*Haliotis*) and for the sea slug (*Lacuna*). The sea slugs eat holes in the fronds which are responsible for the specific name. *Porphyra* reproduces both sexually and asexually. By the asexual method a spore (monospore) is produced by a thallus cell. In the sexual phase the egg after being fertilized divides into four spores (carpospores) which are thrown off in the same manner as the asexual spore. None of these reproductive units are ciliated, but the monospore and sperm are slightly amoeboid.

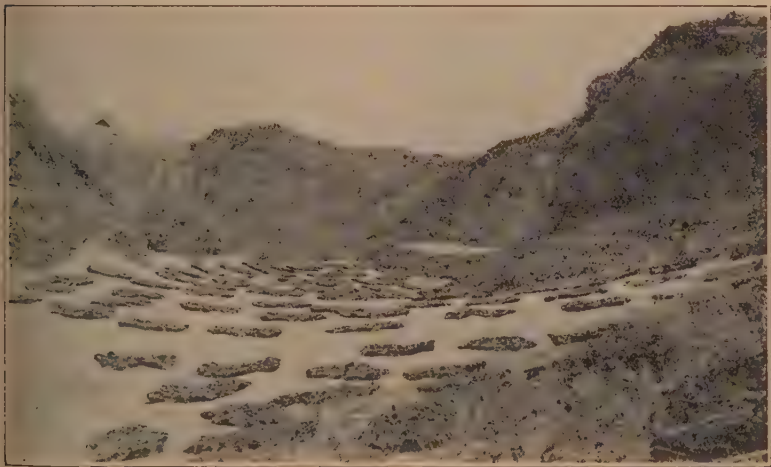


FIG. 26. *Porphyra* drying on the beach. Camp of Yuen Bon, Pescadero. Photo by Paul Bonnot, May, 1929.

There are two methods of gathering *Porphyra*. In the northern part of the state individuals gather the seaweed, dry it and sell to Chinese buyers located at definite points along the coast. The pickers are white men and Indians who live in the vicinity. In the southern part of California the Chinese are the only pickers. The business is an old established industry on this part of the coast. At intervals along the coast, close to some prominent reef or rocky section of the shore the Chinamen long ago built shacks as living quarters and store houses. One, two or three men constitute a camp. The camps are individual enterprises owned by one of the men or by the several who use it. From September until April the cabins are locked and empty. During November and December the camp owners may appear for a few days. They burn over the rocks on which they expect their crop of seaweed, using either kindling made of drift wood or big gasoline

blow torches. The fire clears the rocks of undesirable seaweeds and slugs and leaves a clean surface for the spores of the *Porphyra* to settle on and begin their growth. About the first of April supplies are hauled in, wood is cut for cooking and the seaweed crews start gathering their harvest. They work the low tides even at night. The seaweed is pulled from the rocks by hand and put into baskets. Two of these baskets on a shoulder pole are taken from the shore to higher ground to be dried. The wet seaweed is dropped loosely into rectangular "mats" about eighteen inches long, twelve inches wide and three inches thick. In a couple of days these mats have shrunk to about an inch in thickness. The natural mucilaginous content causes the individual fronds to adhere to each other. The mats are then stacked under cover ready for market. The seaweed is not dehydrated beyond the point of being rubbery. The dried material represents only one-fifth the weight of the wet. When enough dried material has been gathered for shipment, it is packed in large cylindrical burlap bags. The bags weighing about two hundred pounds each are shipped to San Francisco or to China via San Francisco. A small amount is used by local Chinese.

The average price in San Francisco in 1929 was 12 cents a pound. In 1930 due to the decrease in value of silver in China and the consequent decline of the buying power the price has dropped to 7 cents and there are few orders at even that price. A good many tons of the 1929 crop are still in storage awaiting orders. In 1929 300,000 pounds of *Porphyra* (dry weight) were harvested.

DISTRIBUTION OF SEAWEED CAMPS

Fort Bragg	G. Y. Hing, buyer
Gualala	Kong Yick, buyer
Point Arena	Yong Chong, buyer
Pescadero	Yuen Bon, harvester
Pigeon Point	Low Hing Tong, harvester
Ano Nuevo	Sun Lung, harvester
Monterey	Ye Chong, buyer
Monterey	Yee Hing, buyer
Monterey	Wing Chong, buyer
Cayucos	Chow Che Lee, harvester
Cayucos	Kin Hop, harvester
Cayucos	Yin Yee, harvester
Cambria	Henry Loo, harvester
Cambria	John Sing, harvester
Piedras Blancas	Hoo Lung, harvester
Piedras Blancas	Lung Hop, harvester
Santa Barbara	Bob Ord, harvester

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NETTING OPERATIONS ON AN IRRIGATION CANAL

By J. B. PHILLIPS

INTRODUCTION

The Division of Fish and Game of California conducted a series of seining tests on the Sacramento River below the pumps of the Glenn Colusa Irrigation District,¹ during the spring and summer of 1929. These seining tests were for the purpose of ascertaining if food and game fish were going through the pumps into the irrigating canal. The results of these operations have formed a basis for a superior court hearing held at Willows, California, May 19-22, 1930, before Judge H. S. Gans of Tehama County. Inasmuch as the results of the operations were considered satisfactory, the gear and methods of operating are herewith summarized for whatever value they may have in future work along this line.

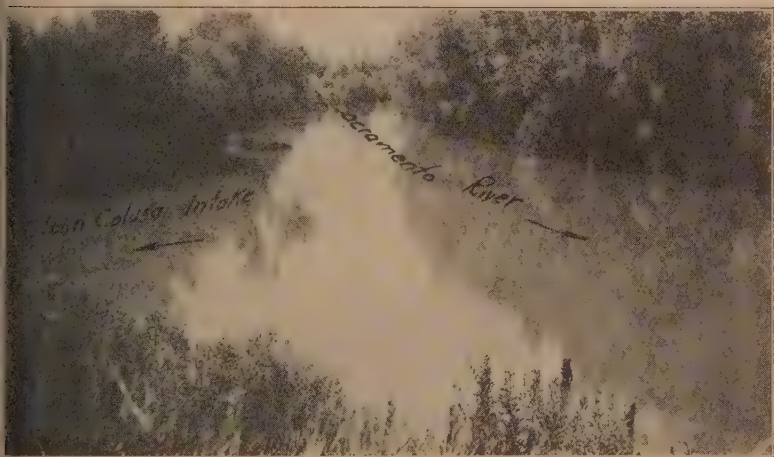


FIG. 27. View showing intake from Sacramento River to Glenn Colusa Irrigation canal. Photo by J. B. Phillips, June, 1929.

Under the direction of John Spencer, director of the Bureau of Hydraulics, J. B. Phillips of the Bureau of Commercial Fisheries and Roy W. Anderson of the Bureau of Patrol, were detailed to carry on the investigation. Supervising Captain H. B. Nidever and Captain S. J. Carpenter commenced the work. N. B. Scofield in charge of the Bureau of Commercial Fisheries acted in an advisory capacity throughout the operations, the success of which was in a large measure due to his helpful suggestions. Earl Tweede, superintendent for the district, kept in close touch with the operations. His helpfulness and cooperation were much appreciated.

Headquarters were established just below the head gates, permission being granted by the district. Seining operations were carried on almost continuously from April 18 to August 20, 1929.

¹ The District has nearly 123,000 acres under its network of canals. This acreage is cultivated in rice, alfalfa, pastures, orchards, and general crops. The assessed value is at \$40 an acre.

DESCRIPTION OF SCENE OF OPERATIONS

Netting operations were carried on in the pool and canal just below the head gates.

The head gates of the Glenn Colusa Irrigation District are located on the Sacramento River, approximately 12 miles east of Orland and 4 miles northwest of Hamilton City. About three-quarters of a mile above the head gates, an island divides the river into two channels, the head gates being located on the west channel. The intake above the head gates is an open channel about the same width as the river, or about 200 feet wide, and makes about a 25-degree angle to the river channel.

Approximately 150 feet below the mouth of the intake is located the battery of 10 pumps called the head gates.² These pumps which are of three types, centrifugal, wood-screw and turbine, vary from 4 to 100 inches in diameter. The maximum capacity during the 192

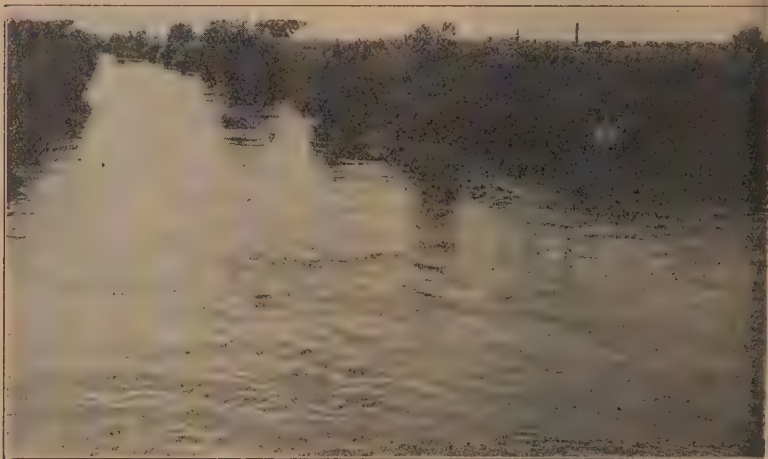


FIG. 28. View from Glenn Colusa Head Gates showing portion of pool and the canal below the pumps where the netting was performed. Photo by Roy W. Anderson, June, 1929.

pumping season³ was 1700 second feet or close to 763,000 gallons per minute. From information obtained, it appears that during the seining operations, the amount of water going through the pumps varied from a minimum of 1150 second feet (516,000 gallons per minute) to a maximum of 15,000 second feet (673,000 gallons per minute). This amount of water coming through the pumps forms a pool just below the pumps, about 200 feet across and in places more than 26 feet deep. The water in this pool boils and eddies in various directions due to the different capacities of the pumps and the position of the pump outlets. The pool narrows down to the main canal in which the current is fairly uniform and steady. The canal portion where the seining was performed is on an average of 85 feet across and

²Pumps are necessary because the water must be raised from 6 to 8 feet in height from the river to the canal during the normal flow of the river.

³The pumping season usually starts about April first and extends into November and December.

12 feet deep, with a slope of about 1 to 1 on the sides. Practically the entire netting was done in the pool just below the head gates and the upper 500 feet of the canal.

DESCRIPTION OF NETS

The nets used in the seining operations were all of the same type, viz "river bag nets." These nets consist of a coarse mesh wing on either side of a long, cylindrical, finer meshed bag; the whole hung between parallel cork and lead lines. Out-of-water dimensions of the net are: wings, each 6 feet deep (vertically) and 17 feet long to center of bag mouth; the bag is 6 feet in diameter and 20 feet long; the end of the bag is closed with a draw string; the mesh of the wings is $2\frac{1}{4}$ inches,

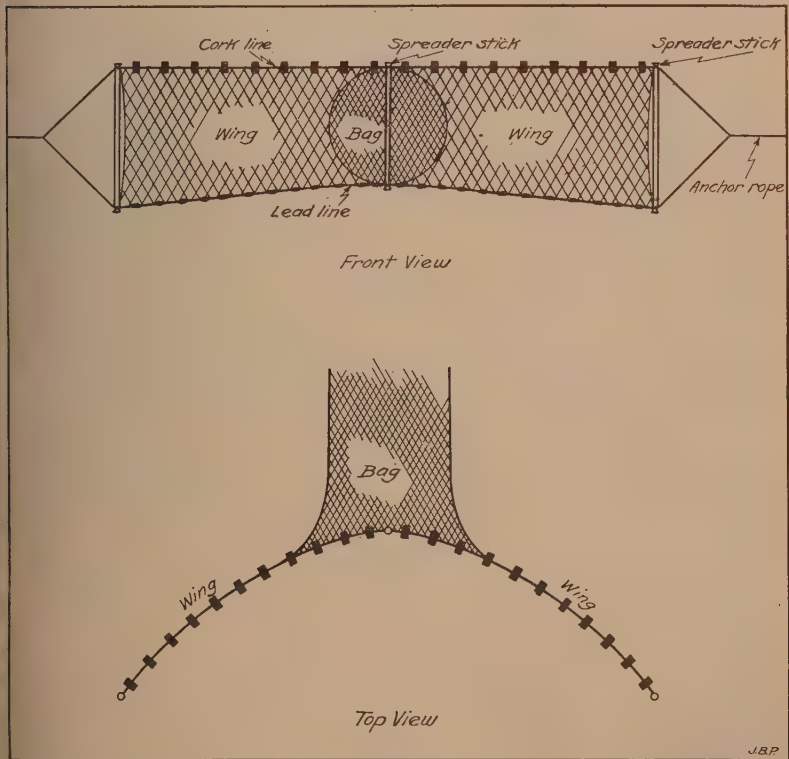


FIG. 29. A two-view drawing of a "River Bag Net," showing the position that it takes in the water. This was the only type of net used in the operations.

stretched ($1\frac{1}{8}$ inches, open); the mesh of the first half portion of the bag is $1\frac{1}{4}$ inches, stretched ($\frac{5}{8}$ inch, open), and the mesh of the end half portion of the bag is $\frac{3}{4}$ inch stretched mesh ($\frac{3}{8}$ inch, open mesh).

It was found that better results were had in keeping the live fish in by inserting a "tunnel" in the bag a few feet from the end. To do this about 2 feet were cut off the end of the bag and this piece shaped in the form of a funnel, the same diameter as the bag at one end and tapering to 6 or 8 inches in diameter at the other end. The large end

was attached to the bag while the smaller end was suspended in the center of the bag by means of radiating pieces of twine of equal length.

METHOD OF OPERATING NETS

When in the water, the end of each wing is attached to a rope that is anchored on shore. The current of the water throws the net into a semi-circle, which in our case measured between 22 and 22½ feet across the front and varied in depth from 6 feet at the ends to 5 feet at the center (mouth of bag). This depth was kept uniform by a small pole at either end and at the center.

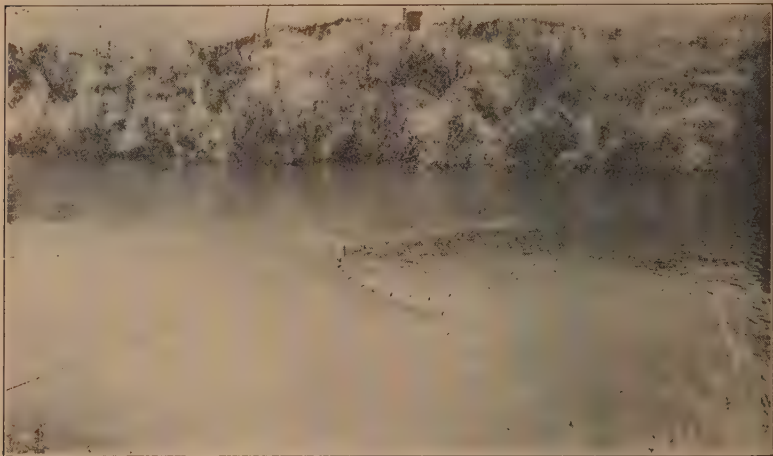


FIG. 30. A "River Bag Net" fishing. For this picture the cork line has been brought out of the water by the rope stretched across the canal. The bag trails behind, just under the surface of the water. Photo by J. B. Phillips, May, 1929.

Due to the strength of the current, the ropes were made fast on shore first and the net then fastened to the ends of the ropes in the water. In detail, this was done as follows: The desired position of the net in the water was chosen with due respect to suitable means of anchorage on shore. One end of a rope was then anchored on one bank of the canal, the balance of the rope taken into the skiff and the skiff was propelled until approximately the desired position of the net in the water was reached. The end of the rope that was to anchor the other wing of the net to the opposite bank was then tied to the free end of the anchored rope, and the journey continued across to the other bank where the second rope was anchored. Piling the net in the stern of our skiff, the wings of the net were made fast to the two free ends of the ropes and the net placed in the water. The anchor ropes were then freed, allowing the net to swing open. We found that best working results were obtained by having the anchor ropes at about a 45 degree angle to the mouth of the net.

When the nets were placed in the pool just below the pumps, they were tried experimentally at various depths. The depth was regulated by attaching weights to the bottom of the brail sticks at either end of the wings.

The nets were raised from the water and examined twice a day, in the early morning and in the evening. The nets were raised in the following manner: The mouth of the net was closed by bringing the two wings of the net together with the aid of a half-inch rope having a snap hook fastened to one end, and passing through a small metal snap block. The skiff was rowed to one end of the net and the block snapped on where the brail ropes are tied to the anchor ropes. The rope was then evened through the block, so that when the snap hook was fastened to the other side the two wings could readily be brought together by pulling on the free end. With the wings together, it was an easy matter to pull the net into the boat without detaching the net from its anchor ropes. The contents of the net were then emptied into the boat by loosening the draw string at the end of the bag. While the net was being pulled into the boat, it was shaken as free as

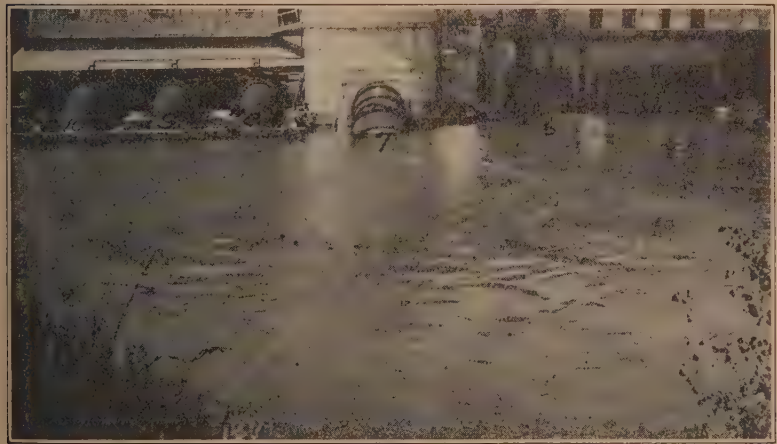


FIG. 31. View looking upstream showing portion of pool and some of the pump outlets that make up the "Head Gates." A net is almost submerged in the pool below outlet 7. (No. 5 to 10 are pump outlets. Outlets 1 to 4 are to right of picture.) Photo by J. B. Phillips, May, 1929.

possible of any debris and examined for tears. If the tears were minor they were mended in the boat; if serious, the net was detached from the anchor ropes (keeping the two ends of the anchor ropes fastened together for convenience in replacing the net), and taken to shore for a more detailed and proper repairing. After the bag was emptied, the net was either taken to shore as explained or set in a fishing position again by casting the net into the water bag first, then freeing the anchor ropes. During low water, dredging was done above the pumps by the Irrigation District in order to have a greater head for the pumps. On these occasions large amounts of debris went through the pumps. During these periods, if the nets were not taken out of the water they were kept closed by keeping the anchor ropes tied together after the nets were raised in the morning. Then in the evening when dredging operations had ceased, the nets were again set free in a fishing position.

About once every two weeks, a net was taken out of the water and given a "blue-stoning" (blue vitriol : $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$), in order to remove algae growth that had accumulated on the webbing and ropes. A net was taken out in the morning, allowed to dry during the day, and soaked in the solution over night. The net was placed in a barrel, water poured in to cover the net, and the blue-stone placed in a cloth sack on top. The heavier specific gravity of the solution will cause it to shrink readily as it is formed. The proportion of this mixture was 8 pounds of blue-stone to 100 gallons of cold water.

RECORDING AND PRESERVATION OF EVIDENCE

The specimens or pieces of specimens were tabulated as to the net in which they were found, condition when found in net, species, sex, and length to nearest one-eighth inch. The smaller fish, such as the salmon and shad fingerlings, were wrapped in cheesecloth, while the larger fish and larger pieces were strung together. Tags bearing lot numbers were attached to facilitate examination at any time.⁴ Food



FIG. 32. Part of one morning's catch, consisting of nine adult shad which were all damaged by pumps. Photo by Roy W. Anderson, August 18, 1929.

and game fishes were separated as much as possible. Weekly reports were sent to the head office. These reports included, besides the above data, the daily records of water temperatures (morning and evening) weather conditions, and heights of water (taken from gauges of District). In fact, the daily records and observations can not be too full as work of this kind will in many cases serve a two-fold purpose: first to determine if valuable fish are being destroyed; second, anything of scientific interest, bearing on the migrations of fish and similar data.

The specimens obtained through the seining operations were preserved in formaldehyde solution.⁵ In preserving fish the specimen

⁴Notations were made with lead pencil.

⁵The regular Commercial solution of formaldehyde is 40-per cent strength. A solution of ample strength for preserving fish is obtained by adding 9 parts of water to 1 part of the commercial formaldehyde.

above the fingerling size should be slit along the abdomen so as to allow the preserving medium to permeate the inner organs. Otherwise, the specimens may be perfectly preserved on the outside but decomposed within. The specimens were first put down in 20-gallon fish shipping cans, such as are used by the Bureau of Fish Culture. It was found after a period of time however that the formaldehyde would eat through any exposed parts of metal. The specimens were then transferred to 20 and 30-gallon barrels, which served the purpose very well.

When transporting the formaldehyde solution can be poured off or the specimens taken out of the solution and simply kept wrapped in moist sacks, excelsior or other like material. In fact after a period of two weeks or more in the solution, specimens can be kept for indefinite periods in this manner. If the evidence is to be presented in a courtroom, it should be soaked for a day or more in several changes of fresh water so as to remove as much of the free formaldehyde as possible.

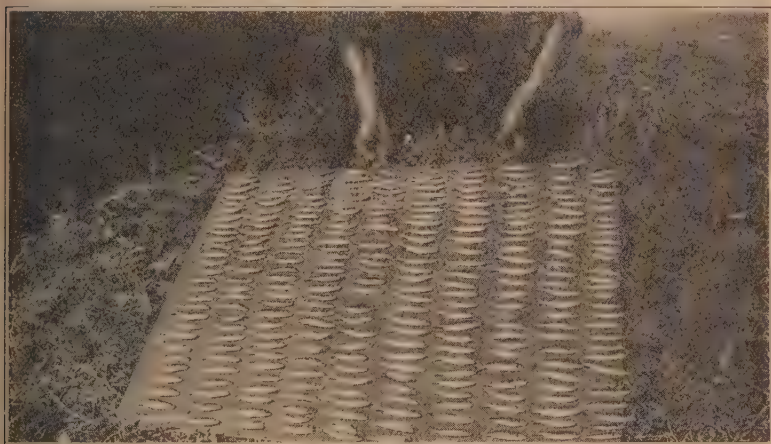


FIG. 33. Part of one morning's catch consisting of 290 salmon fingerling that were found in one net. Photo by J. B. Phillips, May 26, 1929.

BRIEF SUMMARY OF RESULTS OF OPERATIONS

Throughout the course of the netting operations, the usual number of nets fishing were two. During this time, which was about 4 months, we found close to 5600 fish or portions of separate fish in the nets. Eighty per cent of the total were food and game fish which included the following species: chinook or king salmon (*Oncorhynchus tshawytscha*), steelhead and rainbow trout (*Salmo irideus*), striped bass (*Roccus lineatus*), large-mouth black bass (*Micropterus salmoides*), blue-gill sunfish (*Helioperca incisor*), Sacramento perch (*Archoplites interruptus*), shad (*Alosa sapidissima*), catfish (*Amciurus nebulosus*). Salmon and shad formed 70 per cent of the food and game fish total. Rough fish included the following: Sacramento sucker (*Catostomus occidentalis*), carp (*Cyprinus carpio*), split-tail (*Pogonichthys macrolepidotus*), Sacramento pike (*Ptychocheilus grandis*), hardhead or black fish (*Orthodon microlepidotus*).

The number of fish netted was theoretically only a small percentage of those going through the pumps, as each net covered only a portion of the pool or canal. In the case of the fingerlings, which made up 86 per cent of the food and game fish total, the percentage netted was figured as 1 to 3 per cent. This percentage was obtained by comparing the cross-sectional area of the bag with the cross-sectional area of the pool or canal, where the net was located. This took for granted that the fingerlings would go through the large meshed wings. Also, schooling types of fish, such as the salmon and shad, could be expected to be found anywhere in a vertical cross-section below the pumps due to the egg-beater-like effect of the pumps. The term "fingerling" was used to designate all the young fish up to 5 inches in length, the fish over 5 inches being terms "adults." The bulk of the fish was caught in the nets during the night as evidenced by early morning findings.

Since only a small percentage of the numbers of fish going through the pumps were actually netted, the work shows that this irrigation district is continually destroying great numbers of valuable food and game fish.

THE RELATIVE EFFICIENCY OF THE SEMIPURSE SEINE COMPARED WITH THE ROUND HAUL NET

By H. C. GODSIL

Within the past two years some important changes have been effected in the nets used in the sardine fishery. Members of the State Fisheries Laboratory have investigated these changes, and two publications on the subject have been written, one of which is still in press. ("Success of the Purse Seine Boat in the Sardine Fishery at Monterey, California," by J. B. Phillips, Fish Bulletin No. 23, just recently published, and "The Ring Net, or Purse Lampara in the Fisheries of California," by D. H. Fry, Jr., which is now being printed.) The writer is not primarily concerned with this problem. He has nevertheless had the opportunity to note the affect of changes in gear upon the catch of a particular boat fishing sardines at San Diego. The results are rather striking. Since they may be of interest to the industry in general they are recorded herein.

In the sardine seasons of 1928 and 1928, all the local boats fishing for San Diego canneries used the round haul (lampara) net. At the opening of the 1930 season, one boat had converted its lampara into a half ring or semipurse seine. This was done at a relatively small expense by lengthening the net a trifle, increasing the depth of the wings and adding a purse rope to the lead line so that the net could be closed rapidly. At somewhat greater expense a power winch was installed on the boat to facilitate the pursing of the net. The remaining boats in the fleet continued to use the round haul net.

The writer watched with considerable interest the success of this boat, and later decided to make a comparisan with one or more boats using the lampara in both years. The one boat finally chosen (A) was of the same size, and in regard to its net and the number of men in the crew was in 1928 strictly comparable with the one (B) under consideration.

In order to secure representative figures, only those days were selected when both boats landed sardines. This occurred 16 times. The total landings for these 16 days were:

Boat A	Boat B
397,345 pounds	379,065 pounds

The slight difference is in favor of boat A. On eight of these 16 days, boat A had the greater tonnage; while on the remaining 8 days, boat B was more successful. It is apparent that in the season of 1928 when boats and nets were comparable, results were strikingly similar.

Let us now examine the figures for 1930. Boat A remains as in 1928, with gear unchanged. Boat B has meanwhile converted its round haul net into a half ring or semi-purse seine and installed a power winch. Other factors remain the same.

The total lands for the season 1930 were:

Boat A	Boat B
354,270 pounds	657,390 pounds

Boat A secured this amount in 19 successful trips, while B landed nearly twice that quantity in 21 trips. As in 1928, we shall select only those days when both boats landed sardines. There were 14 such occasions, and the total landings for these days were as follows:

Boat A	Boat B
267,750 pounds	529,440 pounds

In these 14 days, B landed just twice the quantity of fish, or a daily average of 37,817 pounds against 19,125 pounds for A. The averages for the 16 selected nights in 1928 were similar for the two boats (24,834 pounds for A, and 23,691 pounds for B). In the same year each boat was more successful than its competitor eight times in the 16 days. In the 1930 season boat B surpassed A, in the quantity landed, 12 times out of 14. On the assumption that the net was the controlling factor and that no other influences were consistently operating to favor B, we may conclude that in this instance the round haul net was only about 50 per cent as efficient as the half ring or semi-purse seine.

GAME BIRDS AND CITRUS FUMIGATION

By GORDON H. TRUE, JR.

For a number of years the Division of Fish and Game has been receiving, at intervals, reports of heavy mortality among game birds, particularly quail, as a result of the commercial fumigation of citrus groves. It is a practice among citrus growers to fumigate their groves with cyanide gas for the purpose of controlling scale and other insect pests. This is accomplished by placing canvas "tents" over the trees to hold the gas which is then introduced. The "tents" are left on for a specified length of time and are then "pulled" to the next row of trees. Since the fumigating is done at night roosting birds may be imprisoned beneath the canvases and destroyed by the poisonous cyanide fumes. Hence the reports from various individuals and sportsmen's organizations of "hundreds of birds" being destroyed where this method is in vogue.

Since it was obvious that a detailed study of the situation was necessary, a survey of a number of groves was made by Deputy E. C. Vail who chose for his work the citrus-producing area to the east of Dinuba and Visalia in Tulare County. Deputy Vail commenced his investigation on July 10, 1930, and continued the study for period of 20 days during which time 14,916 trees, comprising 18 distinct groves, were fumigated. Of this number 4925, or approximately one-third of the trees, were inspected. The inspections were made at dawn following each night of fumigation. A record was made of the number and species, the latter in so far as it was possible, of birds and other animals that were destroyed and notes were taken relative to the situation of the grove with respect to the surrounding country and to the activities of the fumigating crews.



FIG. 34. The result of commercial fumigation of seven acres of oranges on the A. L. Arnold Ranch: Twelve quail, three roadrunners, four doves and one goldfinch. Photo by Gordon True, Jr., July 15, 1930.

Quail were found dead in eight of the groves, the total kill amounting to 27 birds. Twelve birds were found in one grove, two others yielded four and six respectively and one was recorded from each of the remaining five. The largest number were found in an orchard which was bounded on three sides by wild, rocky land. Deputy Vail had visited the grove on the previous evening and had watched five coveys of quail, numbering in all about 75 birds, coming to roost. Dead doves were recovered from six groves, the maximum kill in any one orchard being a half-dozen birds. The total number was twenty, a large proportion of which were young birds which were not yet able to leave the nest.

The list of birds also included a number of non-game species; namely, 17 sparrows, ten mocking birds, three goldfinches, three roadrunners and one linnet, a bluejay and a "brown bird somewhat smaller than a robin" which was probably a towhee. To the list of birds must be added the record of the deaths of four cottontails and one unfortunate tree-toad.

The above record of birds taken shows that one bird was killed for every 100 trees fumigated, or approximately one bird to the acre. In considering game birds alone the ratio becomes one to 200, or one game bird to two acres. When the number of birds which probably spend the night in an orange grove is considered, the death rate is not very large. These results would seem to lead to the conclusion that the problem is not yet a really serious one especially when the importance of the fumigation work is considered.



FIG. 35. Birds killed by fumigation: Six quail, seven doves, thirteen linnets, seven mockingbirds. Photo by E. C. Vail, July 29, 1930.

A perusal of the notes taken by the investigating deputy reveals the fact that nearly all of the birds killed were, at the most, half grown, some being destroyed in the nest. Most of the adults seemed able to leave the cover as the "tent" was being pulled over. Here, we have another interesting fact. In those trees which were of a relatively small size bird mortality was the greatest because, due to the size of the trees, the time required to "pull" the canvas was short. In the older groves, where the trees were larger, the extra time required in setting the correspondingly larger tents gave the birds an opportunity to make their escape. Still another point to be noted is the disposition of members of the crew. Some men, hearing a bird strike the inside of a tent, would lift a corner of the canvas and release it. Others did not care to take the trouble and in consequence, the birds were killed.

Serious or not, any condition resulting in a needless loss of wild life should be corrected if possible and there are certain steps which may be taken to reduce the number of birds killed as a result of cyanide fumigation. First, the orchard owner, who should be interested in maintaining the population of game birds on his property, should go ahead of the fumigating crew and drive out the birds; second, the loss may be considerably reduced if the members of the crews will make it a practice to release imprisoned birds when it is possible; and lastly, in those groves in which large numbers of birds are killed year after year spraying may take the place of fumigation as a method of controlling insect pests.

REPORT OF DAMAGE DONE TO PROTECTED GAME BY COMMERCIAL FUMIGATION IN TULARE COUNTY

By Deputy E. C. Vail

Date	Orchard owner	Location	Number of trees	Variety	Number inspected	Quail	Doves	Cotton-tails	Yellow warblers	Mocking-birds
July 10	H. Brauns, Woodlake	Half mile east of Woodlake	1,000	Oranges	500	1				
July 11	Mrs. Lankins, Woodlake	Two and one-half miles east of Woodlake	800	Grape fruit	315					
July 11	R. T. Lankins, Stone Corral	Foot hills one-half mile; grain two sides	1,000	Grape fruit	300		4		1	2
July 12	J. D. LaGrande, Elderwood	Three-quarter mile to foothills	280	Oranges	280					
July 12	Kline Brothers, Twin Buttes	Orchard, all sides	700	Oranges	104					
July 13	M. Flodin, Ivanhoe	Grapes, three sides	1,600	Oranges	340					
July 13	Marks Brothers, Three Rivers	Pasture, three sides	186	Grape fruit	186			3		
July 14	Kline Brothers, Twin Buttes	Orchard, three sides	2,000	Oranges	200					
July 14	Jack Kortz, Woodlake	Orchards on all sides	1,000	Oranges	200					1
July 14	Mrs. Lankins, Woodlake	Orchards on all sides	500	Grape fruit	50	1				
July 15	L. T. Arnold, Twin Buttes	Pasture, three sides	700	Oranges	700	12	4	3	1	
July 16	D. L. Strine, Ivanhoe	Oranges, west and north; grain, east and south	700	Oranges	400					1
July 16	Kline Brothers, Twin Buttes	Oranges, north and east; pasture, south and west	800	Oranges	50			1		1
July 18	H. W. Anthony, Stone Corral	Pasture and grain on all sides	600	Oranges	400	1	4		1	1
July 19	Peter Flodin, Ivanhoe	Vineyard, east and north; pasture, west; oranges, south		Oranges	450	1	1	1		
July 20	U. T. Strine, Ivanhoe	Oranges, north, south and west; vineyard, east	1,600	Oranges						
July 21	P. Wing, Three Rivers	Grain and pasture, all sides	1,000	Oranges	200	1	1		1	
July 30	Harold Ranch, Arosa	Three miles north, 10 acres	450	Oranges	250	4	6	1		7
				Oranges		6				114

* English sparrow. * Road runner. * Brown bird. * Linnet. * Blue jay. * Tree toad.

NOTE.—Nearly all birds killed were half-grown or less. Found that the chance of catching birds is a lot less in large trees where they use forty-foot sheets, or better. The larger tent takes longer to put on and gives birds better chance of escape. Where fumigation was done in moonlight or light night, the birds flushed ahead of crew.

Found that the average kill would not run over one bird to every one thousand trees, and in questioning men that have followed fumigation for years, found that they all agreed that their experience had been approximately one bird to every one thousand trees.

The disposition of canvas crew had some bearing on amount killed. Some men were inclined to raise the tent and free the birds when they heard them hit side of tent; others were not interested enough to give the little extra effort.

The largest kill checked was at the Arnold Orchard which butted up against the rocks in foothill country, and I counted five covey of quail going to roost at 7.30 p.m., in trees. Perhaps seventy-five birds in all and out of that number found twelve dead.

CALIFORNIA FISH AND GAME

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All material for publication should be sent to Leo K. Wilson, 510 Russ Building, San Francisco, California.

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There is often a difference between what laws the hunter and angler want and what laws are most effective in insuring a state-wide supply of game and fish for the hunter and angler.

RESEARCH ACCOMPLISHMENTS SUMMARIZED

John L. Farley, executive officer, reviewed the research work of the Division of Fish and Game in an address on August 28, 1930, before the Section on Scientific Research of the Commonwealth Club of California. His remarks constitute a clear and terse statement of major accomplishments. Readers of CALIFORNIA FISH AND GAME are familiar with many of the details presented, but it is doubtful if they have a comprehensive picture of the entire field of endeavor. In this sense the address is an invaluable contribution and is presented in full.

The Bureau of Commercial Fisheries claims the credit of having compiled the first complete and accurate record of the catch of fish of commercial importance in California based on fishing effort and equipment units. The system developed in finding facts and acquiring the statistical record has served as a model for the entire world and has been adopted by the federal government and by other states. In this respect California not only is in the front rank, but heads the procession.

The bureau, in its organization, places research on an equal plane with the administration and enforcement of laws and regulations. Its laboratory at the Terminal Island is a fact-finding institution, systematically collecting and cataloguing information in order to obtain a clearer picture of what is happening to the resources safeguarded. Research is not considered a side issue. It is directly depended upon for success.

A knowledge of the amount of fish that may be caught each year without impairing

the future of a particular fishery is considered fundamental to the management of the fishery. Basically, this involves an understanding of the extent of the supply and the amount of fishing effort put forth to acquire a given return. For instance, if with increased fishing effort—larger and faster boats, more efficient gear and greater expenditure of energy—the catch of a particular species actually becomes less and less, it is reasonably certain that the species is on the decline.

Two systems—catch records and sampling the catch at regular intervals, enable detection of the earliest signs of depletion. The first method is largely statistical. Records accurately compiled through the years show that daily catch of each species of commercial importance for each boat in each fishing region of the state. The second, the sample method, enables studies of the age classes of fish and determines whether a sufficient number of older fish are surviving to insure a future supply.

By means of this system the bureau is able to continually "feel the pulse" of the commercial fisheries, to trace the effects of legislation and to recommend to the legislature corrective measures necessary to maintain the fisheries in a healthy condition.

A consistent effort has been made to secure accurate and scientific data on the life histories of certain species. Of outstanding value are studies made of the habits, breeding capacity, rate of growth and times of run of the striped bass. Such notable success has attended the introduction of this fish that it is sufficiently numerous to support a fishery and afford sport to thousands of anglers as a game fish. So enthusiastic have some striped bass anglers become over the future possibilities of the sport afforded that they have demanded further restriction of the commercial fishermen. Because of the scientific data on hand, the division has been able to point out that possibly three-fifths of the spawn-bearing run of striped bass escape the fishermen's nets. This percentage assures a breeding stock sufficient to maintain the supply. During the open season another safeguard prevails. The law forbids the use of a net having a mesh of less than five and one-half inches. It is estimated that at least one-fourth of the run is protected by this regulation.

Fish Bulletin No. 24, "An Analysis of the Catch Statistics of the Striped Bass Fishery of California," by J. A. Craig (1930) gives statistics showing an increase in the abundance of striped bass while undergoing the strain of fishing.

Another *Fish Bulletin No. 17*, "Sacramento-San Joaquin Salmon Fishery of California," by G. H. Clark (1929) analyzes catch records and summarizes the other factors which have conspired to bring about depletion.

As early as 1897 attempts were begun to solve the problems connected with the life history of salmon. Under the direction of Dr. J. O. Snyder, of Stanford University, marking experiments were carried on. Salmon were tagged and operations conducted until the sea range of the fish was known. Sacramento River fishes were found as far north as the Klamath River, but did not go into Alaskan waters. Klamath River fish were caught as far south as Monterey Bay. The investigations also disclosed the rate growth of salmon of known age.

Dr. Snyder is now conducting an inquiry to arrive at some conclusion as to the contribution of natural propagation to the salmon supply. The Shasta River, tributary stream, has been selected. Salmon formerly spawned in great numbers in this stream and the run is still relatively numerous. It possesses the usual barriers and obstacles, such as dams, irrigation ditches and the like. A rack thrown across the stream is so constructed as to make possible an accurate enumeration of the fish as they ascend to the spawning beds. A system has been devised to accurately approximate the number of fingerlings which the spawning beds yield. The movements of the ensuing young will then be followed until they reach the mouth of the main river and their welfare studied in relation to obstacles encountered which civilization has imposed. During the enquiry no artificial stocking of the Shasta River is to be made.

Stream surveys for guidance in planting young fish are underway. Blind planting or planting by rule of thumb methods is wasteful. Wisconsin has developed a wonderful system. A set of cards record the carrying capacity and the productivity of certain streams. Details as to the food producing capacity of the streamside, of light penetration and the different planes in depth where different species thrive best have been worked out scientifically. California is compiling a set of cards and it is hoped that the data they will contain will permit more intelligent and efficient planting.

The health of the people of the state due to sickness from eating sardines has been safeguarded by investigations of the Hooper Foundation for Medical Research. In 1924 a canneries inspection service was organized and with this came the realization of the need for research to eliminate

so-called ptomaine poisoning. At the request of the canners a sum of \$15,000 has been allotted each year since 1926 to the Hooper Foundation. Under the able direction of Dr. K. F. Meyer the organism causing the poisoning was determined and ways and means of preventing its presence in canned goods determined. Now, by cooking under proper pressure and temperature for a sufficient length of time and by using other sanitary precautions, the organism has been almost entirely eliminated to the great benefit of the canning industry and the general health of the people.

The Hooper Foundation has attempted to discover the source of mussel poisoning. During summer months the use of mussels is always somewhat dangerous because it is impossible to distinguish the sound from the diseased. The poison is believed to be the result of certain diatoms used as food by the shellfish and may be influenced by spawning conditions. Deputies of the division have aided greatly in this cause by securing specimens up and down the coast for examination.

The duck disease causes the loss of millions of waterfowl yearly. Paul Shaw, a toxicologist working under Dr. Meyer, has determined the probability of "alkali poisoning." By forced feeding in the laboratory of certain mixtures of salts known to exist naturally in the diseased areas, a "sickness" has been produced. This knowledge is of immense value. Its importance in the selection of game refuge sites is obvious.

Studies to identify external and internal parasites of deer, quail, ducks, geese and other game species and to determine the life-cycles and pathogenicity of these parasites have already produced many "finds," the results of which have been published in the Division's quarterly, CALIFORNIA FISH AND GAME.

Of outstanding interest is the discovery of a malaria blood parasite in California valley quail by E. C. O'Roke, which is transmitted by a biting bird-fly belonging to the same family as the sheep tick. This parasite has undoubtedly been a factor in reducing the quail population.

To preclude every possibility of pheasants raised on state game farms being liberated and serving as reservoirs of disease for the infection of poultry, the game farms have been rigidly inspected and the unfit eliminated. Electric hatching and brooding devices have done away with the use of domestic hens and removed all possibility of young pheasants contracting disease from domestic mothers.

Agriculture has furnished an attractive food supply for game. Rice growers complain of depredations of mudhens and of

blackbirds. In some regions deer have become so numerous that they constitute a threat to growing crops. Field investigators have attempted to winnow the real damage from the fictitious and exaggerated. Efforts to perfect control measures and find effective repellants are in progress.

Inquiry is being made into the food habits and economic relations of birds and mammals considered destructive to game. Fur-bearers represent a valuable natural resource. It is hoped that the facts gathered will show whether campaigns desired by sportsmen to exterminate certain predators are wise or whether the better course to pursue is that of allowing control measures which provide an annual crop for the trapper.

Considerable work has been done on the status and economic value of birds by Dr. H. C. Bryant. The western meadowlark has been studied with reference to accusations of grain growers that the bird was destructive to crops and for this reason not deserving of protection. Stomachs of more than 2000 birds proved its value as a weed destroyer and as a controller of insect pests. Stomach analysis of roadrunners showed the bird to be an efficient destroyer of rodents and insects. A bulletin is now being printed on the "Quail of California" by Donald D. McLean. This is the harvest of intensive field investigations extending over the whole life-cycle of the species studied, and presents many new facts contributing to a better understanding of the valuable upland game birds.

The wide field covered by the research work of the Division and the numerous projects brought to completion should merit the growing confidence of the people of the state that conservation problems are being scientifically solved in adequate measure. Research has been on a high plane; directed by men of state-wide and national reputation. Valuable facts have been gathered, useful in planning protection and legislation.

SLAUGHTER OF GAME BIRDS IN EUROPE LAMENTED

A statement recently coming from the office of the National Association of Audubon Societies says the commercialization of wild game birds continues without abatement in Europe, according to the American Game Protective association.

Dr. T. Gilbert Pearson, who has just returned from presiding at the fourth conference of the International Committee

of Bird Preservation, which was held in Amsterdam, Holland, stated:

"I again stressed the importance of stopping the sale of game birds not actually reared on estates or game farms, as such commercialization tends to overkill with a resultant depletion of the total supply.

However, my appeal failed to strike a single responsive chord. Among the official representatives from our national sections in 16 countries, including many of Europe's leading exponents of wild-life protection, I did not succeed in getting one supporting voice. On other occasions in the past, my pleadings have likewise fallen on deaf ears. From these and other experiences, it is quite evident that Europe is a long way from accepting the idea of the noncommercialization of wild game which is one of the first principles of wild-life conservation in the United States and Canada.

Golden plovers are netted in great numbers in some of the western European countries. I was told that 30,000 were taken in a single season in one section of Holland. Migratory quail are also netted as they cross the Mediterranean northward in spring and southward in autumn. On May 2, 1930, the ship *Umbria*, arrived in Genoa, Italy, from Egypt with 30,000 live quail aboard, and was informed that all ships coming from Egypt at this season of the year bring enormous consignments of these live birds which are used for food, and to a considerable extent are shot from traps.

Ducks are caught in great numbers in the carefully planned 'decoys.' Between 100 and 200 such decoy ponds appear to be in operation in Holland; others in Germany, France and in some other countries.

Many species of song birds still continue to be taken in nets, the neck wrung and the bodies sold for food.

However, some progress is being made. Prussia recently had adopted a very forward looking law for wild-life protection. Among other things, it prohibits the use of pole-traps for catching predatory birds. Belgium has restricted the number of species of small birds that can be caught in nets, snares, or shot for food; and lastly, the Fascist government of Italy has forbidden the blinding of song birds by red-hot needles, to be used as decoys, a practice which has been in vogue since the days of ancient Rome."

IN MEMORIAM

I. L. KOPPEL

Deputy I. L. Koppel died Wednesday, November 5, at his home in San Jose. For two years he had known that his time was short, but during that time he never lost interest in his work.

He was first appointed a regular deputy August 1, 1909. Like many other good officers he had a profession—law, but he found more pleasure in conservation work than in law practice. The respect in which he was held by his fellow citizens of San Jose was evidenced by the mass of floral tributes and the huge attendance at the funeral Friday.

We extend our most sincere sympathies to his wife and son, Irving.

STUDY FISH PROBLEMS

The following is an excerpt from an editorial, entitled "Facts or Fiction," which appeared in the *Yreka News* during the latter part of October:

"The research work that the State Department of Natural Resources, Division of Fish and Game, is doing in Siskiyou County is one of the most hopeful signs that has come to light that something intelligent may be done to stay the rapid decline of salmon in California streams and notably in Klamath River.

It is a foregone conclusion that the Klamath will be the last stand of this finest fish in the state. Pollution of water, salt water barriers and other obstructions are rapidly exterminating them in many of the streams, once their natural habitat.

It is sincerely to be hoped that the opposition that has developed to the work at the mouth of the Shasta River and in other places in the county will be dissipated with a better knowledge of the real significance of effort that is being put forth under the direction of J. O. Snyder.

That Mr. Snyder is a real friend of the fish and is an authority on the subject, can not be doubted by anyone who has listened to his intelligent discussion of the problems now facing the fishermen of the state.

The ordinary sportsmen is likely to jump at conclusions, based on the meager observation and hearsay and, in the main, the knowledge of the average fisherman regarding fish is very little and that very little is often erroneous. The proof of this lies in the fact that no two fisher-

men, as a rule, will agree upon any one set of statements.

The division is almost daily disproving one or more of the popular beliefs regarding the habits of the fish and discovering facts which the layman never dreamed of. It is not within reason that this data is not going to be valuable to the state in its effort to stop the depletion of the salmon supply."

HUNGARIAN PARTRIDGES ARRIVE
IN CALIFORNIA

Twelve crates of Hungarian partridges have just arrived in California. The birds were purchased in Czechoslovakia several months ago, shipped to New York and thence across the continent by fast train. Only 12 birds were lost out of the shipment of 643.

The crates were taken from the cars at Suisun, Solano County, and transported to the state game farm at Yountville. It is the third shipment of these birds to be received in the past few years.

According to August Bade, superintendent at the farm, the partridges will be held in specially prepared pens until they have rested sufficiently from the long trip. When the birds are acclimated and conditioned they will be ready for liberation.

Hungarian or gray partridges have met with such fine success in many states and Alberta that a long open season is permitted and the birds are increasing even in the face of this practice. Their natural reproduction, as checked in many places, is just double that of quail and pheasants. In Washington it was found that they increased at the rate of 16 for each pair while the average for quail and pheasants was eight.

The natural habitat of the Hungarian partridge is the rolling hills and grain fields that was the former home of the prairie chicken. On the wing they are a match for the speed and cunning of the bob-white or California valley quail. Another fine feature of this bird is the fact that they do not congregate in numbers during the winter. The family, under the guidance of two parents, remains as a single unit until the mating season.

It is the life history and natural habits of the bird that led the Division to believe that they would do well in this state. When established, the Hungarian partridge will not only offer excellent sport for the hunter, but will improve the natural beauties of our out-of-doors and divert concentrated shooting of any species.

LION LANDS ON BACK

Cats do not always land on their feet! The old theory that no matter how the members of the cat family fall, or how far, they invariably land on all four feet has just been discredited by Jay Bruce, state lion hunter.

Bruce and his trained dogs recently treed a huge male mountain lion up in the Silver Creek country. The animal, it weighed 160 pounds, climbed to the 60-foot level and was attempting to climb to a higher position when it lost its footing.

The animal made several complete circles while falling and landed squarely on

Bruce said that the animal measured seven and one-half feet from nose to tip of tail. It had killed many game and domestic animals before being taken.

JUDGE LUCAS DECIDES CASE

An important decision affecting the conservation of the commercial fisheries of California has just been rendered by Superior Judge H. C. Lucas of Santa Cruz County. The case was an action brought by the Fish and Game Commission against six Santa Barbara fishermen for operating drag nets in what is popularly known as San Luis Obispo Bay. The law prohibits the operation of drag



FIG. 36. Display of mountain lions caught in the mountains of Ventura and Santa Barbara counties with steel traps by Herman Keene. Photo courtesy of Shaffers, Ventura, California, April, 1929.

its back. The force of the fall caused the cat to lose consciousness for several seconds and the dogs "piled" on to finish the job.

But the lion soon came to and had different ideas about the problem. Clutching one of the dogs with its powerful front feet it sought to rip the animal open with the hind claws but Bruce interceded with a well-directed pistol shot and ended the lion's career.

In examining the cat the hunter discovered that one front foot contained but one toe and claw. A farmer in the district reported that a lion had left its toes in a trap, about ten miles distant from the spot, last January.

nets in bays in district 18, an ocean district which runs from Monterey Bay to Ventura County, and was passed by the legislature for the purpose of preventing the wholesale destruction of baby hali but which take refuge in the shallow water of bays. The technicality raised by the fishermen who operate the boat for Larco Bros., well-known fish dealer of Santa Barbara, was that the Coast Pilot describes San Luis Obispo Bay as the small inner anchorage which extends from Point San Luis to the mouth of San Luis Obispo Creek, a distance of about three miles, and what has been popularly considered San Luis Obispo Bay, the large bight extending from Point Bucho

Point Sal, is without a name and is therefore not a bay.

This decision will bar drag net boats from operating in this large bay lying off Pismo and Oceano beaches and will do much toward saving what is left of the halibut banks in that region.

A number of years ago the use of drag nets was prohibited in district 19, which extends from Santa Barbara County to the Mexican line, for the reason that when these nets were operated in shallow water for halibut they would destroy, for each ton of fish of marketable size they would catch, three times that weight of halibut too small to market. When this destruction is considered in numbers of small fish killed and thrown away, the waste and damage to the fishery can be appreciated.

The case for the Division of Fish and Game was handled by Assistant Attorney Ralph W. Scott, and much credit is due him for his energetic handling of the litigation.

OIL POLLUTION

There is a very interesting story in the October issue of *The Auk* on "The Menace of Oil Pollution." The author, Frederick C. Lincoln, gives much data on this strong menace to our bird and fish life and he tells what is being done and should be done to prevent the trouble.

In 1914 there were only 501 vessels using oil for propulsion with a total of 1,721,747 gross tons—by 1925 the total number increased to 3822 vessels of 19,372,615 tons, and these figures include only vessels of 500 gross tons or over.

The story tells of the practice of pumping salt water ballast from oil tankers beyond the three-mile limit and that a report in 1925 showed that approximately 5500 tons of heavy oil are discharged in nonterritorial waters near New York Bay, and that possibly 17 per cent of this may be carried ashore by the winds, tides and currents.

It has been found, the author says, that when birds alight on an oil-covered surface, their feathers soon become so saturated with the oil that they are unable again to take flight. The fine down that insulates their bodies against cold and water becomes matted and water-soaked, the skin is exposed to the elements and the birds die from cold and hunger, or are mercifully drowned. Live birds in this oil and water-soaked condition have been rescued, washed clean with soap or some other solvent or emulsifying agent, dried out, and liberated without suffering any apparent effects, but unless human aid is rendered birds that alight in an oil-covered area are almost certainly doomed to death.

Apparently the waters along the eastern coast suffer a great deal more from this menace than do ours on this coast. He tells that the waters of Chesapeake Bay, Palmico Sound, and points in the coastal waters of South Carolina, Georgia, Florida, Louisiana, Texas and the Pacific Coast from Puget Sound south to San Diego, have frequently been the scene of great destruction of waterfowl from oil.

"What is the answer?" the story says. "Many states have passed stringent anti-pollution laws which if vigorously enforced would do much to relieve the deplorable conditions existing in vast areas of coast, river, and marsh." Some states, notably California, have shown a most commendable activity in enforcing these laws, but in others they exist merely on the statute books.

In conclusion the story says that "the laws enacted should help to reduce the danger from oil pollution, but constant vigilance must be exercised so that still further improvements will be made and that there will be no recurrence of the heavily polluted waters that have already taken such heavy toll from the migratory waterfowl of America."—Earl Soto, San Francisco, October, 1930.

ALTITUDE OF BIRD FLIGHTS

A very interesting article appeared in *The Condor*, November, 1930, entitled, "Aeronautics of Bird Flight," by Sterling Bunnell, from which the following is quoted:

"As seen from an airplane birds are creatures of the earth's surface and seldom stray far above it. They seem to be part of the evolutionary biochemical reaction between the surface of three media—land, water, and air. In fact, animal life and plant life are seldom found far from the juncture planes of these three media. Hawks and buzzards are sometimes seen at 1500 feet above the earth, and migrating birds have been seen at great altitudes, but they have been at such times crossing mountain ranges and so have not been far above land.

"Colonel R. Meinertzhagen, after interrogating 600 English aviators, concluded that most birds migrate at altitudes under 3000 feet with the majority well under this altitude, and that they usually fly below the clouds, so as to keep landmarks in sight. In only 36 instances were birds seen over 5000 feet and in only seven recorded cases were they seen between 8500 and 15,000 feet.

"Flying is laborious at high altitudes where the air is thin. The familiar Jenny airplane reached its maximum height at about 5000 feet and many modern planes can not exceed an altitude of 10,000 or 12,000 feet. Therefore, most of the birds

that soar, with such few exceptions as the condor of the Andes, which has the greatest wing area of any bird, are found at lower altitudes. An example of the poor flight of birds in high altitudes is seen in the method of quail hunting in the Andes at 15,000 feet, where a crowd of people and dogs run after the quail which average but three flights and then is so exhausted that it can be picked up."

VALUES OF WILD LIFE

"It is always difficult to foresee the needs of the generations to come, and nowhere more so than in the field—we may indeed say the wide realm—of enquiry; yet it is safe to anticipate the needs of handing on to our successors all we can of our and their heritage of the earth as little impaired as we can contrive it to be. We may be sure that they will more readily pardon the waste we may make of its physical resources, its coal and ores, or even of the precious soil, than any unnecessary or avoidable destruction of its organic species. They will require these creatures not only for the advance of knowledge in general, but for much they have to learn concerning the safety and development of the mind and body of mankind. It is, for instance, evident that, in studies yet to be made as to the nature and modes of prevention of human diseases, many species of animals are to contribute largely to knowledge as to their nature as well as to the means of prevention. Two out of the limited number of our domesticated animals, by their physiological characteristics, now preserve us from two of the most fatal maladies. The cow has by the method of vaccination effectively relieved us of small-pox, and the horse is the only available creature for producing the antitoxin of diphtheria. Thus we see that, with the next beast swept away, there may go the possibilities of help to life as well as to learning.

"The ways in which we and our heritors may best deal with this difficult problem of making over the surface of the earth with the least possible destruction of its indigenous life have been the object of serious study by many scientists. The arrangements to attain this end cannot be made at once, they must be gradually developed, as required by the advancing needs. What is, however, needed at once is a sense of the situation, a clearing away of the primitive childish notion that the marvellous life of this world is fitly to be taken as a toy for man, to be carelessly rent away with his plough, or slain for his diversion. The establishment of a truly civilized state of mind, as regard man's duty by those creatures of all degree who share life with

him, is the necessary foundation for such conduct as will keep our race and time from shame in the age to come."—*Man and the Earth*, by Nathaniel Southgate Shaler, (Duffield & Co., New York), pp. 207-208. 1917.

IS WATER A NECESSITY?

How long can animals go without water? The answer to such a question is sometimes invaluable aid to the science of game management. Water is a necessity like food, shelter and safe retreats from enemies. It is a factor of major importance in the selection of a game refuge. There is reliable evidence, however, that animals can go without water for long periods when green deserts have been found many miles from water holes and apparently have satisfied their thirst by eating succulent plants. The same may be applied to deer. Sheep resemble deer in many respects. Recently in the Lassen National Forest a band of 1500 ewes and lambs went for 26 days without water. This sustained period was undoubtedly possible because of the succulent forage consumed.

CONSERVATION PROBLEMS

It is true that natural enemies, disease and starvation raise havoc with wild birds and wild mammals, but these ills our wild friends have always had to combat. But think of man-made destructive agencies that man had added—guns, traps, snares, poisons, trained dogs, decoys, sneak boats, sink boxes, blinds, motor boats, automobiles, airplanes, baited waters and fields. And then we wonder why our wild life is disappearing.—*Montana Wild Life*, November, 1930.

WHO PAYS THE BILLS?

Some day the great mass of people who hunt and fish are going to wake up to the fact that they are not going to be able to have twenty dollars' worth of fish and game for two dollars. Every passing year sees a nearer approach to an artificial supply of fish and game, if the demand of a growing throng of sportsmen are to be anywhere near satisfied. This artificial supply costs money. The question is: Who pays the bills?

The natural answer to this question is: The class that derives the benefit. Sport today in almost any form is expensive. Hunting and fishing are by no means the least expensive as most people follow them. If an adult trout costs half dollar to raise and a man thinks he's entitled to fifty in the course of a season, just how does he expect to get them for a dollar or two? If it costs state seven dollars to raise and liberate pheasant, just how can the sportsman

expect to get six for two dollars and a quarter? If some day it dawns on the sportsman that it really can not be done, then the next thing he will do will be to ask who is going to pay the balance.

The restoration of fish and game in his country is going to be a costly undertaking. Money is coming from somewhere; the work is to be done. Someone will have to foot the bills either in cold cash or its equivalent, work.

In the meantime those who realize that fish and game restoration is necessary and also that it costs money are asting about for means of raising the funds with which to work.

One of the first suggestions is always the idea of raising the cost of hunting and fishing licenses. That, however, defeats the fundamental purpose. If hunting and fishing are wholesome, health-giving pastimes, then we will be a better nation of people in time to come if a quarter of our population follow these sports instead of one-tenth.—*The Journal*, Reno, Nevada.

POISON CAMPAIGNS DANGEROUS

It is an extremely dangerous practice to place poisoned meats in an endeavor to control animal or bird pests.

In many localities where such methods have been practiced the greatest toll has been taken among valuable dogs. The loss of these trained dogs has proved to be a greater detriment to control measures than the good elicited from the spreading of the poison.

Persons who are qualified to utilize the poison method are few and far between. It not only requires a knowledge of the life habits of the pests in question but also a technical understanding of the values and strengths of the poisons to use.

Often times an appeal is made to the Division to send trained hunters into a locality where a predatory animal, especially the mountain lion, is causing great damage. If the hunter learns that poisoned meats have been spread he will, as a rule, not take his valuable dogs into the district; it is easy to understand that such a move would be utter folly.

Trying to control animal pests in our towns and cities by the poison-meat method is even a great deal more dangerous than the open-country practice. Here human life is jeopardized, especially among the child population. Valuable catch dogs and pets also fall a prey to the method.

The city of Martinez, Contra Costa County, has just experienced a siege of indiscriminate poison spreading. Although no human lives have been taken to date,

the casualties among the licensed dogs of the city have been large.

Authorities of that city are at a loss to explain the reason for such a poison campaign by unknown persons. An efficient pound system has kept Martinez free from stray dogs, there is no rat problem to solve and the only other animal that would be eligible for such a campaign would be the cat.

To kill off fine hunting dogs and pets in an endeavor to rid a city of cats seems like a criminal practice. Stray cats should be eliminated for the sake of birds, disease and other reasons but sane methods should be chosen for such work.

Don't take the stray cat out into the country and turn him loose—to prey on quail and other birds that nest on the ground. In the towns and cities the pound master is equipped to handle the situation in a painless and humane way. In the country the rifle or shotgun is by far the quickest and most satisfactory method of ending the depredations of the stray cat.

If you are uncertain, get expert advice from city authorities or game wardens in the district.

POCKET GOPHER DOES DAMAGE

The damage done by the pocket gopher in California is estimated at \$8,000,000 a year, according to the monthly bulletin of the Department of Agriculture. Citrus and other fruit trees, as well as many field crops, suffer from the depredations of this pest. It is estimated that 80 per cent of the losses of young roadside shade trees are caused by these rodents.

NEW PICTURE REEL OF ANTELOPE

Pronghorned antelope in California have just been recorded on motion picture films by E. S. Cheney, photographer for the Division. The pictures were taken in the northeastern part of the state.

The trip, just completed, was the second made in the past few months by Cheney to obtain visual records of these elusive big game mammals of the state. Pictures, not yet released, show that excellent results were obtained.

These animals were once very plentiful in California. History says that the great valleys of the state once supported hundreds and maybe thousands of antelope. Being exceedingly wary and swift of foot the animals were enabled to combat all forces of nature except man.

With the discovery of gold in California hundreds of fortune seekers swarmed into the state. Naturally they relied greatly on the fish and game for sustenance.

Disappointed in the gold fields many turned to agriculture. This resulted in

the erecting of fences, the destruction of natural forage, tilling of the soil and the crowding of the game from natural habitats.

By the year 1900 it was discovered that the pronghorned antelope had been reduced to very small bands in six widely separated areas. Steps were immediately taken to protect these animals from complete extermination and close watch was made by the Division for game poachers.

Cheney, during his recent trip, made note of the size of the bands to be found. It is his opinion that there is a small increase in the antelope population. This increase, however, is coming very slowly, he reported, because in the bands surveyed he saw very few young animals.

The pictures obtained will form an invaluable record for the files in the division. When released these films will be shown by the bureau of education to schools, colleges, lodges, sportsmen organizations and other educational agencies. The division not only hopes to present valuable data in this way but also to create a real interest in our native mammals.

In making the picture it was necessary for Cheney to hide in a tree, approximately 40 feet above the ground. He experienced extreme difficulty in handling his equipment secretly in such a perilous position. However, he succeeded in gathering some excellent photographs before he was discovered—then the fleet antelope bounded across the rough country with the grace of great birds. Other pictures were made from surface blinds.

DUCKS IN CALIFORNIA

Some idea of the supply of ducks that this state once supported can be gained from a story appearing in the September number of the *Associated Sportsmen*, under the heading, "Our Ducks." The writer of this story says that he got his data from the notes of John Exley.

The story, in part, follows:

"Forty years ago ducks in California were like the grains of sand along the seashore—they were countless. Sportsmen who believe they have seen many ducks at any time during the last ten years can have no conception of the tremendous numbers that existed in the old days. Hunters of that period laughed at the idea of possible reduction, let alone extermination. "That would be impossible," they said, "so long as there was feed there would be millions and millions of ducks and geese." So we slaughtered game thoughtlessly and without any qualms of conscience.

"Forty years ago you didn't have to go far for a bag of ducks. If you lived in

San Francisco all that was necessary was to cross on the ferry to Alameda or to drive to South San Francisco. If you were an experienced duck hunter you could readily kill from 25 to 100 birds in a day within five miles of the ferry building. Bluebill, canvasback, sprig, widigeon, teal, rail, shore birds and bay ducks of all kinds were plentiful in the bay region at that time. The Alameda, San Mateo, Sonoma and Suisun marshes supported a tremendous number of ducks.

"You didn't bother with decoys then; it wasn't necessary. You picked out a line of flight and shot as long as your shells lasted. I recall bags of more than 200 ducks to the gun being made in a day under favorable conditions in this territory.

"In spite of the great abundance of game at San Francisco's back door there were localities in the state where game was even more plentiful, particularly in the Sacramento and San Joaquin Valleys and the delta country. And when Miller & Lux developed an immense tract of irrigated land in Merced County about 35 years ago that territory quickly became the great duck Mecca.

"Confession is good for the soul, they say. When I was a young fellow I was crazy over hunting—it was the sport constantly in my mind. I wasn't satisfied with a day's sport in a week. So in company with several other young blades I launched forth as a market hunter. Many other ardent hunters were doing the same thing, and being thoughtless and fortified with the general opinion that wild game would never become less plentiful we felt justified in our undertaking. Recent reports from the Los Banos country had set our blood afire. So we organized a party, bought a hunting outfit, including camping equipment, a double team and buckboard, "bull guns" and ammunition, and started for duck heaven. It took us four days to cover the mileage now covered in four hours by present-day shooters. When we arrived we added a couple of steers to the outfit for most of our shooting was to be done with four-gauge muzzle-loaders on ducks and geese "worked" from behind cattle.

"All the members of the party were extra good shots with ordinary shotguns but the proper use of the "bull gun" was something else again, while the working of ducks with the aid of a steer required great patience and was considerable of a science. But when you get the duck closely massed and within range, after maneuvering for possibly an hour, it was slaughter—the big gun mowed a lone lane through the birds, and two shot

netted the shooter from 50 to 120 ducks, or up to 75 geese.

"On a quiet winter day, from all over the flooded plains would sound the sullen boom of the big guns, for a number of outfits were at work throughout the season. Market hunting was really hard labor, but it was exciting in a way, with an element of chance, both as to the amount of game killed and market receipts therefrom. If we were lucky we netted \$1.25 per dozen for sprig and about \$2.75 a dozen for mallards. Teal netted about 85 cents a dozen, while widgeon and spoonbill were ordinarily a glut on the market and were reported 'spoiled' as often as not. In fact, a larger proportion of ducks and geese shipped out of the valleys were reported spoiled, legitimately and otherwise, by wholesale game dealers who received them.

"In spite of the hard work, I loved to be out there on the wide plains, in the midst of that great seething mass of wild life. If the occupation was degrading it did not seem so to me at the time, nor did it become monotonous. Great armies of wild fowl poured into the region from time to time. Those were the days when the coming of new northern flights was sights to witness and to stir the blood—not merely a few thousand birds, but actually millions; they filled the heavens; the roar of their wings was like thunder; they came in endless procession; flock after flock as far as the eye could see; when they finally massed they covered acres and acres, and the sounds they made were deafening. You saw great banners of geese, too, sometimes miles in length, and the air resounded with their cries. It was nothing to see from 25,000 to 50,000 geese in a single flock, like a great white or gray carpet on the plain; you might see a half-million geese in a day then. And as you lay in the tent under warm blankets you heard the passing of great bird armies in the night and the high-pitched yelping of coyotes early in the morning, like an alarm clock, after they had fed on duck entrails near camp.

"Very often, for variation, we put aside the bull guns and used our 'popguns'—10 and 12 gauges—particularly when heavy, regular flights were on. All hands were good shots, and the rivalry was keen as to who would kill the greatest number of ducks with a specified number of shells. Constant practice, together with natural ability, was responsible for unusual skill, not only in long range shooting, but in making doubles and crossing shots. We often killed 100 or more birds to the gun this way during a morning or afternoon flight.

"We did not confine operations to Merced County, but, like the nomads we were, covered most of the big duck shooting areas of the state. In the course of a few seasons, however, the shooting fell away badly—the decrease was very evident. Some localities were completely shot out; in others reclamation drove the game away. We felt that something was happening, but just as the sportsmen of today seek alibis for the decrease of game, we attributed it to everything but gun slaughter. Finally results were so poor that market hunting for us was a losing proposition. We were against night shooting on general principles, but mainly because we knew it drove ducks out of the country. So several years before market hunting was prohibited by the legislature we quit the game for good, through necessity rather than through conversion or virtue.

"We are told once more a great drought has invaded the breeding grounds of the north. What will the story be this year? The decrease was rapid, if not alarming, during a period of more than 30 years, when practically normal breeding conditions prevailed. Will the bottom drop out entirely under this added handicap of drought, or will we be able to maintain a fair number of ducks for future sport? I hope so, as I still like to get out where the wild duck holds forth and to bring in a moderate bag. I'm satisfied with a dozen birds or less now, when once I aimed at slaughter—I now know all too well that I share in the responsibility for the great decrease of game in California."

After reading this interesting story it is not hard to visualize the march of an oncoming civilization, crowding and pushing nature's living birds and animals farther and farther from the face of this land. Statistics show that California has gained nearly 6,000,000 population in the past eighty years; there is now, roughly speaking, about 150,000 miles of road and highway readily accessible for automobile traffic; Department of Commerce officials estimate that there are about 1000 airplane landing fields on record, and millions of dollars are invested annually in sporting goods equipment—think of what these few factors mean, alone, in fish and game conservation problems.

It would often seem that many of us do not realize the complex problems connected with this work. When the first white man set foot on the soil of this continent he started to create a change. As man multiplied the change in nature's plan spread out as oil upon the water, until today we have an entirely different continent, from a natural standpoint.

In this work of conservation it is a waste of time and energy to try and arrive at conclusions through comparison with other periods in history. It is a problem worthy of the effort of the most constructive critic and should be dealt solely from a cooperative standpoint.

DEER KILLED IN MORNING

Most of the deer killed during the past season were taken between the hours of seven and ten in the morning.

Although the season has long since closed, the above fact was recently learned in a table compiled by J. S. Hunter. The purpose of the table is to get an idea of the habits of the hunter instead of the usual data on the animals alone.

It has always been the general belief that the majority of the animals were taken early in the morning and late in the afternoon. The table, which is compiled from returned deer tags, gives accurate data as against theories.

The lowest ebb in the hunting day occurs between the hours of 12 noon and 3 o'clock in the afternoon, the table shows. The game bag falls off in a direct line from 10 o'clock in the morning until noon and then holds about the same until 3 o'clock, from then on there is a slight rise that lasts until 5 o'clock, followed by a direct falling off for the remainder of the hunting day.

The total bag for the season is 24,132 animals. This is an increase of 2910 deer, or 14 per cent more than for the season of 1929. The animals were all said to be in prime condition this season, with a very few exceptions.

Three counties were well above the thousand mark in the deer-bagging activities during the past season. These counties include Mendocino with a total bag of 1483 deer; Siskiyou with 1372 and Modoc 1129. Of course there were many other counties in which excellent kills were reported.

And probably many persons will say, "What of it?" after reading of the compilations. In answer it might be well to add that much valuable information has been gained from the tables and this material will be available for application to deer conservation problems.

MULE DEER HUNTING ON THE MODOC

Anyone who has not spent some time traveling among the camps of mule deer hunters in the Modoc region can scarcely realize the enormous "kick" which these people get out of the sport. To thousands of Californians from all parts of the state and from all walks of life, the mule deer hunt in the Modoc Forest is their big annual vacation. These sportsmen,

many of whom come back year after year to the same camps, deserve a great deal of credit for their deep interest in game conservation. Ninety-five per cent of them are more than anxious to observe all state and federal rules and requirements in the woods.

At least 6000 mule deer hunters were camped in the Modoc region on the opening day of the 1930 season. As successful hunters moved out, others came in to fill the gaps, so that this number was fairly constant for at least the first ten days of the season.

Records show 1129 tags turned in to the State Fish and Game Commission covering bucks killed in Modoc County, but since the Modoc Forest has a large area lying in Lassen and Siskiyou counties, it is estimated by forest officers that at least 1350 deer were bagged within the Modoc National Forest during this season, approximately the same number as was taken out in 1926, the last year in which a two-buck limit existed.

The mule deer range in the Modoc Forest is practically all accessible by auto, which makes hunting easy and simplifies patrol. On account of this accessibility, back in 1925 both state and federal officers believed the mule deer doomed to extinction in northeastern California. Legislation, however, came to the rescue. Creation of a new game refuge in the heart of the mule deer territory, the laying out and later extension of District 13, elimination of the shooting of forked horns, the one-buck limit, and the adoption of the tax system have all played a big part in mule deer protection. Today, these same men hold a much more optimistic view for the future of the mule deer. Forest officers from all sections of the Forest report that the mule deer, if not actually increasing in numbers, are at least holding their own, in spite of the annually increasing number of hunters invading their domain.

After five years of registration of hunters in their camps by means of special patrol, officers of the Modoc National Forest are fully convinced that this method is the best means of handling sportsmen during the deer season.

The notebook form "Report on Campers and Sportsmen," designed by Modoc officers, fills every need and is used by regular local game wardens as well as Forest officers. It gives the location of camp, hunter's name, address, his car make and number, hunting license and deer tag number, condition of camp checks fire permit, nonsmoking, shove and ax requirement, a space to note the bagging of a buck and room for remarks. It is sometimes invaluable in cases o

game or fire law violations and is also well liked by the hunters themselves since they can be located by means of the duplicate slip in case of sickness or trouble. All permanent officers carry this form during the open deer season, whether engaged on camp patrol or not.

The system of patrol carried on during the open deer season on the Modoc National Forest, which was started primarily as a fire protection measure, has not only given a better check on deer hunting in general, but has also put us into closer touch with the ideas and opinions of the sportsmen themselves, in addition to presenting an opportunity of inculcating the message of game and timber conservation into the minds of thousands of people who might not otherwise be easily reached.—William S. Brown, U. S. Forest Service, Modoc National Forest, California.

BEARS IN CALIFORNIA

Twenty-two per cent of the bear population of this country is in California. In all there are approximately 52,231 black and brown bear in all the national forests of the United States. It has been revealed that 11,200 of these animals are in this state.

UNITE TO PROTECT WHALE

Japan would unite with the United States and any other country to protect the various species of whales for a number of years in order that the mammals might be studied and given a chance to multiply. Japan complains about the continued diminished whale products in her country, according to representatives of fish exporting firms at Seattle, Washington, who sell whale tails and canned whale meat in the Orient. In Japan the gray whale has disappeared. There has been a noticeable decrease year after year of right, fin-back and humpback mammals found in the sea adjacent to the island empire. Japanese whalers have been forced to take long voyages into the Arctic and far south into the Antarctic to seek supplies for their industries.

STRIPED BASS IN CALIFORNIA

The California State Fisheries Laboratory has recently issued a publication entitled "An Analysis of the Catch Statistics of the Striped Bass (*Roccus lineatus*) Fishery of California," in which the author, J. A. Craig, gives a comprehensive discussion of catch figures in general and a detailed analysis of the striped bass catch per unit of fishing effort during the years 1920-27, inclusive.

This report should be of interest generally but particularly to both sport and

commercial striped bass fishermen in the San Francisco Bay region, as it settles for the present the controversy as to the abundance of this species in the above area.

Craig, who is one of the pioneers in California in the field of catch analysis by unit of fishing effort expended, gives, in the first part of the paper, a complete discussion of the various methods employed in analyzing catch statistics and some of their failings. A review of the history of the striped bass in California, since first being introduced in the waters of California in 1879, is also presented.

The study of the daily boat catches per unit of effort is divided into two analyses: (1) using a selected group of boats; (2) employing a random sample of boats. The author sets forth step by step the analyses, describing the methods used and presenting results in the form of tables and graphs. These two methods of analyses are compared, and a discussion is given on other factors affecting the analyses, such as the shad and salmon catches. Craig concluded that both the analyses showed virtually the same condition of the fishery but that the one using a random sample of boats would be of more use if the analysis were carried on in the future; and that the striped bass fishery was in a healthy condition up to 1927.

Copies of this report, Fish Bulletin No. 24, can be obtained by writing to the California State Fisheries Laboratory, Terminal Island, California.

FISHING AREAS FOR THE CALIFORNIA SARDINE

The major areas in which sardines are taken in California waters are largely determined by their proximity to the packing plants, but the specific fishing localities within these areas are dependent on other factors. Where these localities are and their significance to the industry are discussed in Fish Bulletin No. 25, "Fishing Areas Along the California Coast for the Sardine (*Sardina caerulea*)," recently issued by the California State Fisheries Laboratory.

In the Monterey region as shown by Milton J. Lindner over a ten-year period from 1919 to 1929 the fishing area has expanded to the northward. Until 1926-1927 fishing was practically confined to Monterey Bay, but in the later seasons fishing extended as far north as Half Moon Bay, and since 1929 Monterey fishermen have gone as far as the Farallon Islands for their catches. Each season in the late fall and early winter the Monterey area experiences a period of scarcity of

fish. The duration of this period of scarcity has increased in the later seasons and during this time the fishermen cruise over the widest area to locate their schools of fish. Although there has been an increase in the fishing effort, the quantity of sardines taken in the original fishing grounds near Monterey has remained fairly constant since 1923-1924. The increased catch has been supplied by the regions farther from the port of Monterey.

The San Pedro region as indicated by Frances N. Clark has experienced a similar expansion in the same time interval. Fishing was originally confined to localities near the mainland from Point Dume to Point San Juan. The first expansion occurred in 1925-1926 with the introduction of purse seine boats. Since that fishing season sardines have been taken around all the Channel Islands and off the mainland as far south as Oceanside. During the fall portion of each season the major part of the catch is taken to the north of Point Vincente, but in the winter and spring a greater percentage of the catch is taken south of this point. The number of tons of sardines taken in the original mainland section has remained relatively constant since 1922-1923, and to meet the increasing demand for sardines, fishermen have been compelled to cruise over larger and larger areas.

Three distinct sizes of sardines are taken at San Diego: young fish, termed by the trade "quarter-oils"; intermediate sized fish or "half-pound"; and adult fish or "pound-ovals." The fishing localities for each of these sizes are shown by H. C. Godsil to be distinct. The quarter-oils are taken in greatest abundances adjacent to the sandy beaches of Coronado Strand and La Jolla. The half-pound fish are caught in the inshore region throughout the fall, but in the winter they may be found at a greater distance from shore at almost any point along the local coast line. The pound-oval fishing area extends from Los Coronados Islands in the south to Point La Jolla in the north.

Anyone interested in this publication may secure a copy by writing to the California State Fisheries Laboratory, Terminal Island, California.

DAILY AVERAGE LENGTHS OF THE CALIFORNIA SARDINE

During each fishing season the sizes of sardines caught in California waters undergo definite fluctuations. The details of these changes in the San Pedro area and the similarities and differences between size changes at Monterey, San Pedro and San Diego are discussed in Fish Bulletin No. 26, "Seasonal Changes

in the Daily Average Length of the California Sardine, *Sardina caerulea*," by Frances N. Clark of the California State Fisheries Laboratories.

Throughout a fishing season the daily average lengths are small during the fall months, increase to a maximum in the winter and decrease slightly in the spring. The transition from smaller to larger averages occurs about a month earlier at Monterey than at San Pedro. The average lengths of the fall fish at Monterey are greater than of the fall fish at San Pedro. The winter averages are very similar for Monterey and San Pedro while San Diego averages resemble Monterey more closely than San Pedro. For the ten seasons' studied, 1919-1929, the averages during the second five-season interval were greater than during the first five. This probably resulted from the presence in the catch of dominant size-groups which reached a maximum size during the latter period.

These seasonal changes in daily average size have a direct effect on the industry. More fish are packed in a pound-oval can in the fall months and fewer in the winter. Because of the increase in average sizes in the later seasons, the numbers of fish packed in a can have averaged less than in former years.

The only explanation for these fluctuations in average length within a season, which satisfies all conditions, is the movement of different sized fish into and out of the fishing areas. The occurrence of the same size fluctuations at Monterey and San Pedro, with a month's difference in the dates of the transition from small to large fish, suggests a definite relationship between these movements in the two localities, although the positive demonstration of such a relationship is not possible as yet.

Copies of this recently issued report may be obtained by writing to the California State Fisheries Laboratories, Terminal Island, California.

IMPORTANT CONFERENCE

A conference of importance to our fisheries investigations was held at Pacific Grove, October 6-8 and attended by N. B. Scofield, Tage Skogsberg, W. L. Scofield, and five other members of the laboratory staff. The purpose of the meeting was to correlate hydrobiological work of the Hopkins Marine Station with the work the laboratory is doing on fisheries, especially on sardines and mackerel.

The discussion was opened with a summary of the work at Pacific Grove by Dr. Skogsberg. E. C. Scofield and Milton J. Lindner outlined their work on the early stages of sardine and mackerel.

SPORTSMEN PLANT CLAMS

On one of his recent patrol trips, Deputy Ed Glidden of San Diego, noticed an abundance of small Pismo clams on the beach from Coronado to Del Mar. They were readily identified as *Tivela stultorum* and as a result of his investigations, Deputy Glidden has reported as follows:

"Personally, I believe the sport fishermen to be responsible for the stocking of these clams. A number of years ago, these clams could be bought in the open market and were much sought after by surf fishermen, with the consequence that after the fishing was over, oftentimes bait would be left and as the clams would still be alive, would be thrown into the surf."

As a result of these plantings, the beaches in San Diego county are becoming stocked with Pismo clams.

WINTER WORK AT HATCHERY

Winter activities are in full swing at the Big Creek trout hatchery of the Division. The work consists of cleaning and disinfecting, painting and repairing of the buildings and fish troughs. This hatchery is located on the creek that bears its name, one-half mile above its junction at Scott Creek egg-collecting station in Santa Cruz County.

Results from this hatchery have been very satisfactory. Built in 1927, additions have been gradually made until there are now 56 hatching troughs in the main building.

Reports show that about 5,000,000 eggs were handled at this place during the past season. Besides hatchings and experimental work carried on at this location with steelhead trout, egg shipments are made to various other hatcheries in the state.

Real "fish" activities will not begin at Big Creek until about the middle of January. At this time the steelhead trout generally enter the river on their way to the spawning grounds and are eligible for egg deliveries.

FISH RESCUED

Working hand in hand with employees of the city and county departments in Los Angeles, Captain Chappell and Deputies Bedwell, Towers and Thornburg have been busily engaged in rescuing bass and sunfish in Chatsworth reservoir during the past two weeks. Chatsworth reservoir, which is being drained in preparation for some construction work, offered an opportunity to stock other waters in southern California with these gamey fish and to date nearly thirty thousand adult bass and sunfish have been transplanted

under permits issued by the Department of Fish Culture in Puddingstone reservoir in Los Angeles County and Lake Elsinore in Riverside County. The stocking of these waters will afford some added sport to the angler in southern California and credit is extended to the water and power department of the city of Los Angeles for their aid in rescuing fish and to the Los Angeles County Department of Forestry and the Clevelin Realty Company for their assistance in transporting the fish from Chatsworth reservoir.

FISH TRAVEL GREAT DISTANCES

A rainbow trout tagged at Port Washington, Wisconsin, on July 14, was caught seven days later near Grand Harbor, a distance of 200 miles around the shore line of Lake Michigan. If the fish had traveled straight across the lake the distance would be 87 miles, thus allowing an average of twelve miles per day. By traveling the shore line the fish would travel a distance of 37 miles per day.

A Pacific salmon was marked by the United States Bureau of Fisheries in Alaskan waters and was caught 44 days later 1300 miles away in a Siberian stream. Fishermen who return these tags to the bureau receive 25 cents to \$1, depending on the species of the fish.

MEASURES CLAMS

When you go clam digging be sure to take an accurate, flexible rule. Nails properly spaced on the clam-rake handle make an excellent gauge—one that can not be lost and thus cause the digger to lo some "unlawful" and expensive guessing.

Regulations show that clams of lawful size must not be less than five inches across at the greatest diameter. Persons who take undersized shellfish will be arrested and prosecuted regardless of excuses.

Forrest J. McDermott, deputy commissioner in the Santa Cruz district, declared that many persons come to the clam beds without the proper measuring equipment. Although they can not be prevented from digging and taking the shellfish, they are being closely watched for violations.

BRUSH FIRES DESTROY GAME

Brush fires took their toll of wild life during the month of November in Ventura, Los Angeles and San Diego counties. In a report received from Deputy Emerick of Ventura he writes as follows:

"The Tapo and Potrero fires burned approximately 63,000 acres of forest and brush cover. We had some of the worst weather I have seen for a long time. These two fires took a heavy toll on valley

quail. I judge there were at least 15,000 birds destroyed. Most of these were on the Newhall ranch, Doheny ranch at Santa Susana and the Strathearn ranch at Simi. There were lots of quail in all these localities. The fires burned heavily at night and the quail had no chance. There were a few deer destroyed, no doubt, and I have a report of some five or six that were found burned. I would judge that at least twenty were so killed.

The Pacific Western Oil Company, who now have this Doheny Tapo ranch, are putting out six or eight bales of hay a week for the deer on their property; also a lot of grain for what quail are left.

SEND SPECIMENS

It is important that birds, fish and game animals found dead or sick from unknown causes be sent immediately for examination to Dr. K. F. Meyer, G. W. Hooper Foundation, Second and Parnassus avenues, San Francisco. Don't hesitate to make inquiry.

The following instructions will help to bring the subjects to the Foundation's laboratory in good condition:

1. Don't send them in so they will arrive in San Francisco on a Saturday or Sunday. Put your specimens in cold storage and send them so they will arrive the first of the week, if possible.

2. Send specimens on ice, if possible, and if not possible to do this wrap them up in several layers of paper and keep them from the air. Use a small box when necessary.

3. If the specimen has already started to smell, or spoil, it is hardly worth sending, as little can be determined when subjects are in such a stage of decomposition.

4. Don't remove the intestines. They are often the source of diagnosis.

5. The main thing in the sending of specimens is SPEED—the more the better.

6. Those who send in specimens will receive a prompt report on the findings as soon as the Foundation experts can establish facts.

DUCKS IN CALIFORNIA—MALLARD

Are you familiar with the types of ducks that come to your state every year? Many persons, including hunters, often get a string of the prized waterfowls and are at a loss to name the birds readily. It is the purpose of the following material to offer an understandable description of one of the favorite game ducks—the mallard.

Mallard ducks are a migratory waterfowl that live in marshy areas. We have large numbers of these birds that remain in California the year around and

these in turn are augmented in the winter season by the birds that come down from the northern nesting grounds. The chief local nesting grounds is along the deep sloughs and larger ponds in the Sacramento and San Joaquin valleys.

The mallard duck is one of the most beautiful of the duck family. The head of the male is silky green with a trim white collar; the speculum, or colored area on the wings, is purple with black and white edges; the chest or frontal region of the bird is tinged a beautiful chestnut brown; the back and main portion of the wings is gray, and the black upper tail coverts curl upward into a ring.

The female of the species, like most other members of the bird family, has less conspicuous coloring as a protective means during the nesting season. That is, the bird is so colored that she will "melt" into her surroundings and is almost impossible to see until approached very closely; she also "freezes" and will not move from her nest until almost stepped upon. Her coloring is mottled and streaked in brown; the speculum is purple as in the male members of the family.

These birds present a very formidable appearance while in flight. They appear extremely large and heavy and fly with great speed. When the wings are spread the white underside is quite noticeable and the spread tail of the male shows a band of white.

Because of the peaceful habits, these birds are easily domesticated. Many varieties of barnyard ducks are direct descendants of the beautiful mallard. They are generally seen in pairs and appear to be very devoted to each other. The birds avoid salt and brackish water as much as possible and for this reason will adapt themselves quickly to fresh water lakes, ponds, rivers, etc.; because of the advanced development in irrigation in the great California valley many mallards have been noted nesting in alfalfa fields and along irrigation ditches.

Mallards build their nests out of grasses and pliable stalks. They are rather large affairs and are occasionally lined with feathers or other soft material. As a rule six greenish-white eggs are laid and these are hatched in about four weeks time. The female tends to all the functions of the nest while the male loiter in the general vicinity.

In California the breeding season generally extends throughout the spring months and on through the month of June. During this season the males are moulting and the plumage is much similar in color to that of the females—th

is probably a natural protective measure. After the ducklings are hatched, take to the water and are full grown, the male rejoins his family and swims around in his full "bloom" of color as though he did all the fine work of rearing.

The young ducklings go through a very dangerous period until they are full grown. At this time they are subject to attack by owls, hawks, snakes, minks and other birds and animals and many perish from such causes. Naturalists declare that the tiny birds are often attacked from beneath and pulled under the surface by turtles and large fish for food purposes.

A flight of mallards in a pond create a great deal of noise. One has to hear the familiar "quack" once and the sound can thereafter be distinguished quite easily. When startled they jump directly into the air, clearing all obstructions, and fly off with great speed. The wing action is very rapid and the birds generally fly high; the birds are easily deceived by decoys and will quickly wheel and land among the artificial ducks.

These birds feed principally on vegetable matter; seeds of aquatic plants, grain, grass, crustaceans, mollusks and insects. They do not dive for their food but swim around in the shallow water, tilt or "stand on their heads," hold this position with their paddles and sift the soft mud through their bills.

Of all the ducks that migrate yearly into California the mallard is, without doubt, the most highly prized bird. And California seems to be more fortunate this year than many other localities in that the duck migrations are continuing. Of course ducks are not as plentiful as they have been in former years and this, according to the Biological Survey, is caused by a duck shortage in the breeding grounds.

California has not experienced the severe droughts that have ruined the duck marshes and ponds in other sections of the country and an unusual influx of hungry birds is expected after the real winter weather sets in. For this reason the Division of Fish and Game in cooperation with the Federal Government and true sportsmen's organizations, is doing all in its power to prevent an abnormal hunting of the birds—these organizations are working on the plan that the more ducks spared for nesting purposes will mean more ducks to return in future seasons.

GOOD DUCK HUNTING REPORTED

Good hunting reports have been coming in from various duck clubs throughout

the state. The birds are reported to be in excellent condition.

Extremely cold weather in the northern feeding grounds is said, by many hunters, to have caused the improved shooting conditions. With the feeding ponds covered by a layer of ice and snow the birds were forced to migrate to a milder climate. California is believed to be the objective of many of the flights.

And with the knowledge that the birds are unusually scarce this season, many of the gun club managers are taking extra precautions to see that the ducks get an even break. Every effort is being made to provide good hunting but duck slaughter is absolutely prohibited.

Many of the well operated clubs provide a resting pond for the birds. This resting pond might be termed a sanctuary within the club grounds where the hunted ducks can find protection from the shooters. Such a plan prevents the flights from becoming demoralized and scattered and assures a constant supply of birds near at hand.

Most of the gun club operators warn their guests about the folly of long-range shooting. It has been estimated that for every limit of ducks bagged, a like number escapes, wounded, to die or become the prey of marsh animals.

Ninety per cent of the cripples are caused by this long-range, "gun-stretching" practice. A good hunter will always wait until the flight is within range, select his bird or birds and make his shots count.

To shoot before the birds are within range not only causes a large percentage of cripples but prevents the good hunter from getting a shoot. In many clubs the long-range shooter is soon "benched." If this unsportsmanlike shooting could be entirely eliminated the supply of ducks would be greatly increased.

The wise gun club man also eliminates any early or late shooting habits that the hunter might have. In this way he not only assists in enforcing our game bird laws but helps in conserving the duck supply.

DUCK HUNTING AT SALTON SEA

Salton Sea always had a reputation as being the stamping ground of southern California duck hunters. The outlook for this season is very favorable, large flocks of sprig and widgeon have been sighted within the past week. Thousands of acres of barley and alfalfa are grown in this region, thus offering a fertile feeding ground for the birds. The birds have been seen leaving the Sea late in the afternoon, trailing in from the

feeding grounds again during the morning hours. The lower end of Salton Sea is approximately 210 miles from Los Angeles and may be reached over paved highways.—National Automobile Association.

DUCKS IN SUISUN AND SAN PABLO BAYS

Sportsmen have reported that hundreds of ducks have come into the Suisun Bay territory during the first few weeks in December.

The birds are not only settling onto the baited ponds of the various duck clubs but are also ranging through all sections of the marshes. Birds are said to be in excellent condition.

Bay fishermen declare that great numbers of the birds loaf in the deeper open water of Suisun Bay during the day and fly over onto the ponds during the evening hours. They return to the deep water during the morning hours, that is, unless the weather is stormy and the bay rough.

Sprig seem to be the predominating type of bird, although hunters declare that there are plenty of mallard and canvasbacks. Green-winged teal are not as plentiful in some localities this year as in former seasons, reports state.

Many hunters say that they have had some good shooting on San Pablo Bay during the past few weeks. This territory has always been noted as a canvasback field and hundreds of the birds can be seen out in the bay.

Canvasback ducks can be easily detected because they speed through the air with a noticeable whistling sound and hit the water with a splash. They dive in deep water and seldom perch on the shore. The head of the male is reddish brown, shoulders and chest black and the back canvas-white. They appear extremely large in flight, are stockily built and fly with great speed.

N. Y. BANDED DUCK SHOT IN CALIFORNIA

A banded duck, killed three weeks ago by Felix Ariasi, Santa Rosa sportsman, was banded at Southampton, Long Island, New York, March 4, 1929, according to information received here from the Bureau of Biological Survey, U. S. Department of Agriculture. The duck was shot at Grizzly Island, on Suisun Bay.

REPORT ALL BANDED DUCKS

Duck shooters should not lose sight of the fact that the Bureau of Biological Survey is more interested than ever in securing reports of banded ducks that have been killed on California marshes.

Every year the sportsmen of the entire country come to realize that the matter of waterfowl populations is one of more than local concern. If there are poor results on the hatching grounds in the north, it is bound to follow that the shooting on California marshes, which represent the winter homes of the birds, will be poor.

For that reason, whenever a banded bird is found on the game strap, the band should be removed and a note giving the locality where the bird was killed should be forwarded to the Bureau of Biological Survey at Washington. From these returns those in charge of the work are getting a very definite picture of the areas within which our ducks breed.

DUCKS MIGRATE AFTER A FREEZE

Many hunters are of the opinion that the recent storm that covered a large portion of the Pacific Coast will bring more ducks from the north into California.

Although this may be true, there have been no reports as yet which would substantiate this claim. Naturalists declare that temperature changes have the greatest influence on duck migrations.

When snow and ice cover the feeding grounds in the north and the states in the west, the ducks naturally have to migrate to other fields—in the majority of cases out here in the far west the flight generally leads to California. Unless a freeze takes place the ducks usually remain wherever the feed is plentiful.

It is sometimes true that a storm will scatter the ducks and cause some to leave and hunt for milder weather. By this theory it would seem that the ducks that come in from the north at this time would just about balance up for the ducks that leave for the southern fields during the unsettled weather.

There is this advantage, however, the fine rains have filled many of the ponds with good fresh water and this should attract the ducks in larger numbers than have been present so far this season. The real benefit will not be realized until later on when the food growth has had a chance to develop in the freshly filled ponds.

COOTS ARE CLEAN FEEDERS

Coots, or mudhens, are excellent eating when skinned and broiled. To avoid hunting these birds, which are protected by the Migratory Bird Treaty, on the supposition that the meat is not good is unjustifiable.

Allegations that the bird is not a clean feeder and that its flesh tastes like the

bottom of a mud hole are largely unfounded. The coot feeds more upon the green foliage of aquatic plants than do any of the wild ducks, and it consumes in addition such delicacies as the tubers of wild celery and sago pondweed and the grain of wild rice. It is, in fact, a cleaner feeder than many other birds and mammals eaten by man.

Coots come under the same laws that regulate the ducks. If hunters can be made to realize the true value of the meat they will include this game bird in the day's bag and thus prevent an overabundance in a particular species. Rice farmers have complained on numerous occasions that the coot is doing a great deal of damage to crops—the hunting idea is really the most sensible solution to the problem.

Remember, skin the birds instead of plucking them. It will be found that it is much less work to skin a coot than to pluck a duck—it should not be difficult to sell the merits of the coot on this colossal point alone.

AN EXAMPLE OTHERS SHOULD FOLLOW

A fussy little banty hen and Mrs. Fred Gerard of Middletown, California, entered into a partnership during the spring of 1930 that resulted in the brooding and rearing of a covey of orphaned valley quail. During haying season, Fred Gerard mowed over a quail's nest. The mother quail left without cover, became discouraged and left for parts unknown. The eggs, 25 in number, were placed under a banty hen. In due time they hatched and of the fifteen chicks who made their way into the light of day, eleven lived and are now fully grown.

The baby quail for a time were like so many chicks. As they grew older their wild nature came to the fore and they left the hen and took up a permanent abode in a patch of willows close to the ranch house. The band, their numbers swelled by the addition of several wild quail, often come up to the house and will respond to Mrs. Gerard's call at any time.

Mrs. Gerard and her loyal little helper, the banty hen, deserve much credit for the interest shown in the conservation of wild life.—Fred Herman, Middletown, California.

QUAIL EASILY TAMED

The California quail, now the State bird of the Sunshine commonwealth, has never been a very wild fellow. He always responds trustingly to human kindness, and a very strong proof of his friendliness was given during a recent winter in

Yreka, Cal. Snows had made the food of the quail very scarce, and the superintendent of streets, Edgar Thomas, supplied food to the birds while they could not find their natural sustenance. So tame did they become that they often came out from their cover in Yreka's auto park on to the state highway in front of the city hall. They were not molested, and one might have thought them to be some domestic breed, so free from fear were they, rather than members of a species that is severely hunted at certain seasons of the year. These birds are distant relatives of the friendly bob-whites that live in the east.—U. F. Brown in *Nature Magazine*, October, 1930.

QUAIL SCARCE ON MOUNT DIABLO

California valley quail are on the decrease in the Mount Diablo district.

This territory was once considered among the best quail country in the state, but during the past few years there has been a noticeable scarcity of birds. The geographical nature of the country in this section makes it an excellent place for the propagation of quail.

The reason for the shortage of birds is rather difficult to explain. Several theories have been advanced which have to do with water and food shortages and poison campaigns on destructive enemies, but so far no definite proof has been offered as a solution of the problem.

It is definitely known that the Mount Diablo country is becoming very popular for hikers and picnickers. This growth is quite evident since the highways were improved in the district.

Just what effect this advance of civilization is having on the bird and animal life of the mountain is not known—naturalists maintain that such a condition is regulated by the attitude of the out-of-door public.

Definite steps are being taken to determine, if possible, the causes of quail shortages in various sections of the state and it is hoped to supply a suitable remedy. Full cooperation of everyone is necessary, however, to carry on a successful program in our fish and game conservation.

QUAIL INCREASE IN SOUTHERN CALIFORNIA

Reports from quail hunters in southern California are very encouraging this year. The reason for the general increase in the birds in this section of the state is largely due to the cooperative work of the wardens, sportsmen's clubs and municipal authorities.

Southern California's fish and game problems are very difficult to handle for many reasons, the main one of which is the tremendous increase in the population. Statistics show that there were 4328 people in southern California in the year 1850. This number increased to 270,820 in 1900. In 1910 the population figure reached 705,225 and in 1920 this figure jumped to 1,277,142.

To a person familiar with fish and game problems the above figures will furnish excellent material for reflection. It must also be remembered that there are thousands of miles of "high speed" highways in this section of the state and that thousands of tourists enter the state via the southern route each year.

It takes a great expanse of territory to "house" such a growing population and this in turn creates a hardship on the wild life that must seek new surroundings.

Improvements in game conditions have been pronounced in southern California since the real seriousness of the problem was realized by the sportsmen and indications point to the establishment of a real standard in the field.

MOUNTAIN QUAIL IN MOTION PICTURES

For the first time in the history of the Division of Fish and Game, mountain quail have been recorded under wild, natural conditions on motion picture film.

The pictures which were taken by E. S. Cheney, division photographer, are now being developed and arranged on a reel featuring upland game birds. If the negatives can be judged for anything, the new reel promises to be one of the most interesting and valuable pictures in the entire collection of the division.

In seeking the pictures, Cheney undertook one of the most difficult problems he has faced since registering game birds and animals. The mountain quail is extremely wary and it took hours of patient hiding in a blind near a waterhole before the birds were "shot" in the open. The pictures were taken in the mountains near San Bernardino.

PHEASANTS NOT DESTRUCTIVE

Pheasants and other birds do not attack melons, tomatoes and berries because they have a particular liking for them, but because fruits and vegetables contain water which slakes their thirst. It is not necessary to use rifle or shotgun to keep the birds away from fruit and vegetable crops if containers with water are placed at convenient points where pheasants and other feathered species are found in abundance.

MORE PHEASANTS NEXT YEAR

Work has already started in preparation for the next season at the state game farm at Yountville. Due to the great success in bird liberations during the past year, it is planned to enlarge the capacity of the rearing pens.

It is planned to carry an extra number of laying pheasant hens in order to supply the number of eggs that will be necessary in filling orders that will come from individuals and clubs that want to raise birds for liberation.

In reading reports from middle western states it is interesting to note that some of them have achieved enough success in raising pheasants to declare a short hunting season. It is also gratifying to note that in such states where a season has been opened, the hunters used extreme care in not abusing the privilege.

It is the opinion of officials of this state that with the proper cooperation of sportsmen and ranchers the time should not be far distant when a short season might be declared here. This is not a promise, however, but merely indicates that what is possible in other states is possible here with the proper interest and help.

It is necessary to get these new Yountville pens in order early on account of the time required in growing the cover crop necessary to make the pens right. The ground is cultivated many times and otherwise cleaned. In order to have green food in the pens we have transplanted 3150 kale plants.

They were extremely fortunate at the farm this year in that the rainy weather came at a time to do the most good. Cover crops were planted and received full benefit of the downpour. All indications point to a banner season next year. Much favorable comment has been received from sportsmen.

WARM WEATHER HELPS PHEASANTS

Although the warm weather has proven to be a severe hindrance to the duck hunters, it has created a big advantage for the pheasant enthusiasts.

Many sportsmen are taking advantage of the situation and are liberating the birds in selected territory. Some of these men contend that the mild weather allows the birds to become accustomed to the strange surroundings before being shouldered with winter protection problems.

Whether this condition bears any weight in the welfare of the birds or no is a matter for debate and much can be

said on both sides of the question. At any rate it is known that the warm weather will not do the birds any harm but in the wild places.

During the past week 16 crates bearing 60 pheasants have been shipped to two locations from the state game farm at Yountville. The birds arrive at destinations in good condition and there were but two fatalities reported.

Eight crates were sent to the J. M. Carson ranch, near Arcata. The birds were liberated in the Arcata bottoms along the Mad River and took to the wilds quite readily.

The other consignment of eight crates was delivered at the Fern Cottage ranch, near Ferndale; this ranch is the property of Russ Williams. These birds also adapted themselves to the new surroundings quite readily and from latest reports promise to become well established.

TURKEYS DO WELL AT GAME FARM

Turkeys develop very rapidly under conditions at the Yountville game farm. Such a condition is considered quite unusual because of the particular climate in that district although it does prove that the birds will adopt themselves to various conditions.

A recent report shows that one bird which was hatched in April now weighs in excess of 30 pounds. This is considered remarkable for this class of work.

It is also reported that one of the pullets from the April hatch has already laid four eggs. The birds are all given the best care possible so that when liberated they will be fortified with excellent physical qualities.

Work of liberating the turkeys is progressing very rapidly. However, before any birds are assigned to a territory a personal survey is made by August Bade, superintendent, to see that proper conditions exist for the welfare of the "green" birds.

Careful check is made of the existing predatory animals and birds, and food and watering conditions are taken into account. By such careful work it is hoped to keep natural losses down to a minimum.

PLANT TURKEYS IN SOUTH

Turkey planting is progressing rapidly in the southern part of the state. The liberations are being made under the supervision of E. D. Platt, superintendent of the state game farm near Chino, San Bernardino county.

Occasionally the liberated birds wander to the ranches and farms near the vicinity of the planting and it has been a

problem to prevent these birds from joining the domestic flocks. Farmers sometimes ask for instructions on the art of making the wild birds wilder.

Naturalists explained that the turkey is a native wild bird of this continent. When the pilgrim fathers arrived they found the birds plentiful on the eastern coast and utilized the meat for food. When these early settlers gave thanks for their safe journey across the Atlantic the turkey constituted the principal food at the feast. Thus the turkey occupies an important place of honor in the settlement of North America.

Years of contact with man have tamed the turkey sufficiently to include the bird in our list of domesticated fowls. Also years of indiscriminate hunting have reduced the birds in the natural wild state to a minimum—as a matter of fact the wild birds have been exterminated from many of the natural haunts.

Naturalists know that through carefully planned liberations and protection the turkey can easily be induced to practice its natural, wild habits in the field. Experiments in various places have proven this point.

Several days ago a liberation of 120 birds was made in the Big Pine district. These birds were all raised at the Chino game farm and were not released until the superintendent had made a careful study of the field.

The birds will be protected from unprincipled hunters and predatory animals as well as possible, and close check will be kept on the nesting activities. If some of the birds succeed in raising broods of turkeys in the wild state these flocks will be carefully watched and will be trapped at the proper stage of development.

Instead of holding the trapped birds until they become tame, the game farm attendants will distribute them with flocks of the tame birds and liberate them immediately. It is known that turkeys will follow a leader and that the wild gobblers will generally assume the lead.

In this way the flock will not only be led to a natural feeding ground but will learn to protect itself through the teachings of the wild leader.

Plants are being made in various sections of the southern mountains under this plan and the results are being watched very closely by bird breeders of the state.

TURKEYS IN HUMBOLDT COUNTY

Turkeys have been liberated in Humboldt county.

If ranchers and sportsmen will cooperate as well as they have in the past,

the birds will stand an excellent chance of becoming established.

It will probably take several weeks after liberation before the turkeys become accustomed to the new surroundings. Until that time it will require the careful attention of all persons who come in contact with the birds to see that they receive reasonable protection.

Once the turkeys have gained a foothold and have raised broods they are quite capable of taking care of themselves. A wild bird by nature, the turkey is well equipped to hold his own in the forests and hills.

One of the greatest enemies the turkey has is the "poacher." These lawless hunters do not hesitate to shoot the newly liberated birds, even though the turkeys are half tame, and then as a means of defense they will offer caustic criticism because "nothing has been done to perpetuate a species."

Before turkeys are planted careful consideration is given of the number of types of predatory animals in the selected district. If conditions are found unfavorable for the plant, the birds are not sacrificed. Unlawful hunters are quick to place their crimes on the shoulders of some innocent or "imaginary" animals or birds.

MANY DOVES IN IMPERIAL VALLEY

In a report received from Deputy Ed Glidden of San Diego, he writes the following: "It is hard to realize the vast amount of doves in the Imperial Valley. Unless one is familiar with the conditions it would be hard to believe. They are not in hundreds, but in thousands. In a field near Calexico, doves were so thick the field seemed to move. Food and weather conditions are ideal, which holds the birds in this locality. This, I personally believe, is partly responsible for the scarcity of doves in the adjoining counties. We also noticed a number of the Sonora or white-wing doves mingled with the other species. Also saw an albino dove sitting in a willow tree. This dove was pure white and would have made a wonderful specimen. The writer not having a collector's permit, was content with watching it for a period of time. Deputy Little and I estimated 400 blackneck stilt feeding in one field."

DOVES REMAIN IN NORTH

Several sportsmen have reported that they have noticed small bands of doves in the Sacramento Valley during the latter part of November. It is a supposition that drought in the hills has driven the birds down to water and that they

are remaining in close proximity to farms and vineyards in the district this season.

It is not unusual to see doves at this time of year in all parts of the valley and even extending up into the mountain territories, according to D. D. McLean, field naturalist. These birds are classed as local birds and do not make the migrations south, as a rule, with the rest of the species.

ASIATIC MYNAH IN CALIFORNIA

Watch for and help exterminate the Asiatic mynah, or house mynah, scientifically, *Acridotheres tristis*, because reports are current that this undesirable bird has been introduced into Los Angeles county. The bird, apparently, has not been found in the wild state in California or the rest of the United States before. It has a tendency to destroy fruits and some vegetables.

The bird is about nine inches in length; the whole head and upper breast are black; the remainder of the body is a Quaker brown and there is a broad white wing bar on the under side which is especially noticeable in flight. Its bill and legs are yellow. There is also a mustard yellow patch below and behind the eye. The sexes are alike in appearance.

The bird's one virtue is that it is energetically insectivorous. Colonies congregate in large numbers and at times are extremely noisy. The United States Biological Survey reports that the mynah is closely related to the European starling, another very objectionable bird.

Presumably some of these birds escaped from some private aviary in southern California. One colony is said to have been found nesting in drain pipes near the roof of an apartment house during the past summer. The United States Biological Survey has placed a ban on the importation of these birds until further notice.

GRASSHOPPERS

Grasshoppers are reported as more or less troublesome over practically the entire country from Connecticut to California, and southward to Texas, according to the United States Bureau of Entomology. Serious outbreaks have occurred in northeastern Colorado and parts of Wyoming, Oklahoma, Nebraska, and South Dakota. They are damaging sugar beets in Utah and small grains in southern California.

Among the new publications issued by this government department is "A Study of the Lesser Migratory Grasshopper," by R. L. Shotwell, assistant entomologist.

Although grasshoppers are foods for various fish, game and birds, they are considered to be devastating pests and the bulletin not only deals with a review of the history and synonyms of the species but recommends control measures such as the use of poison bran mash and cultural practices.

CONCERNING OWL ATTACKS

In a note in *Science* for November 1, 1929, attention was called to the attacking of person in Morgantown, West Virginia, by screech owls, and a vague inquiry was made as to whether others had had a similar experience.

It was not long before the inquiry was answered so emphatically as to leave no doubt as to the fairly common occurrence of this experience.

Several answers appeared in forthcoming issues of *Science*, and the author received personal letters from more than a dozen individuals scattered from Texas to Ontario, Canada. Several of the writers were college professors, two were physicians, one was an eminent chemist, one was apparently a lumberman and the occupations of the others could not be determined from their letters.

Several mentioned specifically the screech owl as the attacking bird; one said the attack was by a great horned owl; one bird was apparently the snow owl, and a few writers did not name the owl.

In most cases the attack was at dusk, though one was at dawn and one on a moonlight night.

Five of the writers said the owls had nests or young near by, and gave that as the cause of the attack. One writer thought the owl mistook the hair on the head of the person attacked for some mammal on which it preyed.

Several persons said that the owl swooped down close to the head, snapping its beak but not actually touching the one attacked.

A majority of the correspondents reported the victim struck with claws or beak and sometimes painfully injured. In one case a lumberjack was said to have "carried a sore neck for a number of months." In another case a Louisiana negro lost an eye by the attack of an owl.

In a certain part of one town policemen were much annoyed by the attacks of owls.—*Science*, Vol. 72, No. 1867, Oct. 10, 1930.

GOAT AND DEER

A goat belonging to a private individual in Florida is of greater value in the eyes of the law than a deer that belongs to the people as a whole. Under the law, the

theft of a goat is classed as a felony and conviction for it is punishable by imprisonment for not less than one year, or more than two years, or a fine of not more than \$100, or both.

The illegal taking of a deer in Florida that belongs to the whole people is punishable by a fine not less \$10 or more than \$300, or thirty days in jail, or both.

ADVICE ON CARE OF GUN

This is the time of year when gunsmiths generally find their shops overcrowded with work. In many cases a great deal of this "hunting grief" could be eliminated by a little knowledge on the care of a gun, and, of course, a little application.

W. H. Price, an expert gunsmith in San Francisco, has generously donated the following advice on the subject:

"The cleaning of shotguns, rifles and pistols is such an easy job that most gunsmiths wonder why the job is brought to them. The only necessary tools are steel wool, oil and clean rags, also rods for each. First, wipe out barrels with dry rag. Next cover rag with steel wool No. 0 and rub well, oil on the wool. Next dry rag again followed by oiled rag. Now take oiled steel wool and rub all over outside—this will not hurt bluing. Gunsmiths use steel wool to burnish the bluing. This applies to rifle and pistol as well; no other tricks are necessary. Except in high-power rifles, use plenty of nitro solvent before the final cleaning and oiling. Under ordinary circumstances, this will be enough for all guns.

"Now in case of neglected guns, you may not have the equipment the gunsmith has and in that case you may use plenty of hot water while scouring inside the barrels and finish with a good swabbing, using regular ammonia if the fouling is heavy or of long standing. Do this for a few days before regular cleaning with oil to put away. Use plenty of good oil in all joints and where you can see there is friction. By following these instructions, the only time you need consult a gunsmith is after the season closes. Guns should be stripped and cleaned with good oil to put away; also whenever a gun is submerged, it is best to strip it." W. H. Price, San Francisco, October, 1930.

HUNTERS LIKE DOUBLE-BARRELED GUNS

Double-barreled shotguns are gaining great popularity in the field, according to recent reports coming from the duck hunting grounds. It is also reported that hunters are more careful about observing

the bag limit laws this season than any year previous.

By using the double-barreled guns many sportsmen declare that they are enabled to stay in the field longer to get a limit and that the shoot produces nearly twice as much sport. It is also pointed out that the birds are given a better sporting chance of escape by this method of shooting and that the kill is not so disastrous to any one flight.

A good hunter with an automatic or a pump gun is often able to completely ruin a small flock of ducks. With a two-shot piece such a hunter will pick the two best looking birds in a flight and allow the rest to escape—instead of being absolutely demoralized and scattered the birds will proceed to a place of safety and will become good game for other reasonable hunters in the field in future times.

Naturalists from the Biological Survey, who have been making studies of the duck nesting grounds for the past three years, declare that there is no use in trying to fool ourselves about the shortage of ducks. It is a serious situation, they report, and it is up to the hunters to use reasonable methods in bagging the birds.

Many of the birds are concentrating in California this season because of a shortage of food in other former grounds. This situation makes it appear as though the birds are as plentiful as ever, naturalists declare, and to pursue a "blind" program of slaughter here will mean to create an added shortage of nesting birds in the north for the years to come.

When the duck ranks are greatly thinned the nongame birds in the north have a tendency to crowd onto the nesting fields, according to investigators, and the game birds are thus prevented from completing their brooding habits. Ducks, as a rule, always return to their native haunts to nest. It would thus seem that there is safety in numbers only in the nesting grounds.

Double-barreled guns also cause a lesser number of birds to be wounded and crippled. When a hunter has but two shots at his finger tips he generally waits his time and makes those shots certain. With five or six shells in a magazine the hunter will often take a couple of "good luck" shots at a passing flock and thus injure many birds that he does not get.

Many hunters have reported that they have cut their hunting expenses to a minimum by using a double-barreled gun. This saving was noted in the number of shells fired. When using a pump or an automatic the hunter wastes many shells simply because they are instantly at his command—he will often pump two shells

into one duck when one was all that was necessary.

HOW TO WEATHERPROOF A TENT

If it is desired to make a mixture at home, the following will make your tent both wind and waterproof, but it must not be exposed to heat. On a bright sunny day set the tent perfectly taut, where the sun can reach it from as many angles as possible, after providing yourself with two gallons of turpentine and two pounds of paraffine, and a good stiff broad paint brush. Everything ready, place the turpentine in a pail or pot, add the paraffine, and set this in a boiler of hot water. When the paraffine is thoroughly melted, stir the mixture, remove from the hot water, and paint the tent quickly while the solution is still hot. It will be necessary to work rapidly, but care should be taken to distribute the mixture evenly. The sun will dry and set the mixture.—*Hunting and Fishing* January, 1931.

WATERPROOFING FISH LINES

Rubbing fish lines with a flannel cloth dipped in a mixture of two parts of boiled oil and one part of gold size is reported as a successful method of waterproofing. The solution may be prepared by shaking the two ingredients together in a bottle. The line should be exposed to the air and dried thoroughly before using.—*American Game Protective Association* news service.

HOME-MADE CAMP LIGHT

One of the biggest and most important problems connected with camp life is the lighting system. Anyone who has stubbed a favorite toe; tipped over the last can of milk; jabbed a dirty hand into the butter or blundered into a hundred other accidents while groping around "blind" can appreciate the value of having a good light.

Here is a description of a camp light that I have found to be very satisfactory. It is inexpensive, throws a dandy light and needs very little care:

First—Get a tin cup of good size with a handle.

Then—A flat lamp wick, $\frac{3}{4}$ " in width.

Also—A 10-cent box of ordinary paraffin wax.

And—A piece of small soft wire.

Now fold the lampwick lengthwise and sew it down the side, thereby making a long slender pencil-like tube. Cut this wick now into a length three-fourths inch longer than the cup is deep, and insert the wire in the wick to make it stand erect, bending the wire in such a way as to form a base for the wick to stand

on. Place this wick in the cup and fill the cup with melted parowax.

You now have an effective light that will light up a whole camp—will not spill or run down the sides like a candle. Wind can not blow it out and one filling will last for several nights' use as the wax has to burn and not waste itself.—Darrel B. Foss, Venice, November, 1930.

MOSQUITO DOPE

A formula which will give a firm, whitish, nonstaining cream of pleasant odor is made up of the following ingredients: Citronella oil (Burgoyne's), $\frac{1}{2}$ ounce; cedar wood oil, $\frac{1}{4}$ ounce; spirits of camphor, $\frac{1}{4}$ ounce; and white petrolatum, 2 ounces. Melt the petrolatum or vaseline and then add the other items and place in a tin ointment jar. If you will place the jar on ice or in a basin of cold water and keep stirring until it thickens, it will make a fine mixture. Besides being an excellent repellent against insects common to camp fire, it is soothing and antiseptic to the skin. One application usually lasts a whole night. To avoid using it on the face, some persons employ the cream as a brilliantine for the hair, and it will thus keep mosquitos away about as well as if used on the skin.—Indian Journal of Medical Research, Calcutta.

ERADICATE STRAY CATS

Get rid of all stray cats. The semi-wild felines are taking a heavy toll in the feathered population this year and something should be done.

A most recent complaint came from San Joaquin county. Ranchers in the district complain that the cats are playing havoc with the quail down there this season. Other birds are also suffering heavy losses. One farmer reported that several stray cats are killing on an average of two yellow-hammers apiece per day.

Many requests are coming to the San Francisco office of the division to send wardens to the various districts for the purpose of destroying the cats. Wherever possible this is being done, but due to a limited personnel the division is not always able to comply with the requests; a variety of duties naturally limit the accomplishments of the men.

It is suggested that the ranchers and sportsmen themselves lend a ready hand in the solution of this problem. Semi-wild house cats are exceedingly wary animals and to hunt them down methodically would entail a great deal of expense, time and manpower. The farmer and sportsman stands an excellent chance

of encountering these felines by reason of a constant life in the open.

By far the most successful method of fighting these pests is to catch them at their lairs. Because of a long association with man, a cat naturally seeks barns, sheds or other shelters near a habitation. Deserted farms are often found to be typically "dens" for stray cats; man is generally to blame for this condition in neglecting to take "Tom" or "Maria" along when he moves to a new home.

With the normal source of food removed these deserted cats quickly fall into their natural habits and depend on their hunting ability alone for sustenance. It is a well known fact that a cat favors bird meat above any other source of nourishment. Experiments show that a cat will even leave a pan full of food to go out into a thicket and hunt birds.

By all means never turn a cat loose in the weeds as a means of getting rid of the animal. Instead of ridding yourself of the problem you are merely pulling an avalanche of other troubles on your shoulders; not only your shoulders but on many innocent persons who are trying to protect the bird life of the state.

In issuing this message to the public the division does not wish to create the impression that it is an unreasonable enemy of the cat family. Cats make very good pets when properly held in check. They are also very useful animals in the problem of rodent control.

It is the stray cat that is causing a priceless amount of damage in this state. All deputies of the division have been requested to eliminate these wandering marauders when encountered in the hills and wild places; if ranchers, sportsmen and other bird fanciers will pursue a similar course the problem stands an excellent chance of being well controlled. And the drawbacks accompanying the propagation of California quail will be greatly lessened.

CALIFORNIA AND FRANCE

That California fish and game work is being watched with interest by other countries of the world was brought to mind recently on receipt of the following letter from Louis Kuentz, professeur de langues, 89, Rue Des Martyrs, Paris, France:

"Dear Sir: I would consider it a great favor receiving from you the permission to use the material of the story entitled 'Tai and Carp' published in your CALIFORNIA FISH AND GAME, Volume 16, July, 1930, Number 3.

"May I ask you to be so kind as to lend me, if possible, prints taken from

fig. 75 and 77, pages 235 and 236, or to tell me where to apply to get them, enabling me to give more attraction to an article which is to appear in one of our good magazines to which I am contributing for educational purposes.

"Of course full credit will be given to you for any material and picture.

"Apologizing for the trouble I am giving you and thanking you in anticipation,

"Yours very truly,

"(Signed) L. KUENTZ."

FEDERAL REFUGES

Statistics assembled by the Biological Survey of the Department of Agriculture covering the land status on the Bear River Migratory Bird Refuge in Utah, as of June 30, made public on September 20, show that the lands purchased total 15,860.65 acres; public lands withdrawn, 30,632.12 acres; state cession lands, 2,132.85 acres; lands leased, 7,860.98 acres, and right-of-way easement, 0.14 acre; or a total of 56,486.74 acres. When withdrawal lands exchanged, amounting to 4,099.8 acres, are deducted, the net refuge area is 52,386.94 acres. During the fiscal year 1930 there was expended for lands \$24,547.28; other expenditures for acquisition purposes amounted to \$307.41, making a total of \$24,854.69. The average cost an acre for lands purchased was \$1.55.

Of the 163,468 acres within the boundary of the Upper Mississippi River Wild Life and Fish Refuge, 19,162 acres are reported as agricultural and semiagricultural lands, 20,000 acres as unsuited for purchase, 9743 acres as state and city owned, 25,018 acres as public domain (made part of refuge by executive orders), 1,650 acres as acquired by gifts and cessions, 8777 acres under contract, and 56,548 acres actually paid for, leaving 22,570 acres to be taken under contract.

The cost of examining and appraising 225,000 acres was \$22,500, or 10 cents an acre. This calculation is based on land area examined and takes no account of approximately 70,000 acres of interlocking waters that were covered by examinations. For making boundary surveys \$10,939 has been expended, and \$40,393.46 for negotiating for 65,325 acres under contract or acquired, or an average of 62 cents an acre. This figure is based on the tracts covered by contracts, although all the tracts within the refuge have been negotiated for. The average cost of lands taken under contract is \$6.29 an acre, and the average cost of lands paid for is \$6.06 an acre.

Lands to be acquired for the Cheyenne Bottoms Migratory Bird Refuge, near

Great Bend, Kansas, the creation of which was authorized by act of Congress approved on June 12, are being surveyed by field crews of the biological survey. When the government gains control of the lands needed for the purpose, the refuge established will be of outstanding importance to the birds migrating in the Mississippi Valley region.

Topographic surveys of other proposed refuge areas are being conducted and engineering facts gathered with dispatch. Part of the information being obtained is to enable the biological survey to determine what may be done toward establishing migratory-bird refuges in regions where it may be possible to restore areas now desolate to their natural condition.

These refuges are being established in furtherance of the terms of the migratory bird conservation act, to preserve the birds of the United States and Canada protected by treaty with Great Britain.

RESERVE LAND NEAR DEATH VALLEY

An area of the public domain adjacent to Death Valley, in California, has been reserved from entry temporarily, pending consideration of the advisability of turning it into a national monument, according to the Department of the Interior.

This area is located within, or contains strategic points of unusual interest adjacent to the famous valley, and is considered of greater public value from a scenic and scientific standpoint than from that of economic development.

OPEN NEW SPORT LANDS

In accordance with H. R. 8368, passed by congress and signed by the President on May 15, there will be appointed a commission of three to cooperate with representatives of the Dominion of Canada to make plans for the construction of a highway to connect the northwestern part of the United States with British Columbia, Yukon Territory and Alaska.

Such a passage will undoubtedly have a tremendous influence over fish and game conditions in the northern territory and many sportsmen are of the opinion that strong measures should be taken to cope with this problem when it arrives. It is more than probable that many California hunters will desert the local territory each season to pursue their sport on "less congested soil."

HORSE DISEASE

Nearly 700 horses have been affected with a disease known as Borna disease, *Enzootic encephalomyelitis*, in the San Joaquin Valley during the past few months, according to the Department of

Agriculture. The disease is comparable to infantile paralysis among humans. Mortality has not been unusually high. The disease was recognized in the United States as early as 1847. Control measures are being studied by the Hooper Foundation of Medical Research and the Division of Veterinary Science, University of California.

ANIMAL DISEASES IN THE UNITED STATES

"The United States is entirely free from such serious diseases of animals as rinderpest, contagious pleuropneumonia, surra and foot and mouth disease," according to a statement made by Dr. John R. Mohler, chief of the U. S. Bureau of Animal Industry to the Inter-American Conference on Agriculture, Forestry and Animal Industry that met recently in Washington. Foot and mouth disease has been introduced occasionally, but prompt slaughter of affected animals and disinfection of premises has quickly eradicated it.

Dr. Mohler told delegates to the conference how a national quarantine law should be drawn up to prevent introduction into a country of serious animal diseases. For instance, federal officials should be able to control not only the animals offered for entry into the country but also the materials generally closely associated with live stock, such as hay, straw, forage, meats, hides and other animal products. Some of the most dangerous animal diseases may be introduced into the country through the medium of such materials and products.

Plans for an inter-American cooperative clearing-house for the exchange of information on animal diseases and control measures were discussed. Such a clearing-house would depend on the existence in each country of an efficient national live stock sanitary organization which could enforce suitable regulations for the control of animal diseases. Regular reports of the live stock disease situation should be sent by each country to the inter-American clearing-house for the benefit of all member countries. Unusual disease outbreaks, such as those of a nature not previously known, should be reported by telegraph.

EXPERT DIAGNOSIS

At a recent summer school of the American Fox Breeders' Association, Dr. S. F. Wadsworth emphasized strongly the need of having experts conduct post-mortems on foxes and other fur-bearing animals that die from unknown causes, instead of the ranchers trying to diagnose the cases.

There are pathological changes that a trained man might see, whereas, to the novice the opportunity would be lost. Carcasses should be examined not more than twenty-four hours after death because in some diseases the organisms causing the fatality die and disappear. This holds true in all diseases connected with our wild life.

DECREASE IN HUNTING LICENSES

More than 6,425,000 hunting licenses for taking wild game were issued to sportsmen throughout the United States, including Alaska, in the season 1928-29. The revenue to the states amounted to more than \$9,390,000. This sum includes receipts from combined hunting and fishing licenses but not from licenses issued for fishing only. Detailed figures for the season, compiled by the United States Biological Survey, show a slight decrease in the number of licenses issued and a small increase in the money receipts as compared with the preceding three years. In the 1925-26 season, 5,332,375 hunters paid for their licenses a total of \$7,130,102, while in the 1926-27 season 5,989,795 hunting licenses were issued, bringing a revenue of \$8,187,223 to the states. In 1927-28, 6,462,555 licenses were issued, and the fees paid were \$9,338,173.

New York state, with 677,137 licenses and \$703,047 in money returns, heads the list.

WILD DUCKS ON POTOMAC AFFECTED BY DISEASE

During the past several days a considerable number of dead wild ducks have been found on the Potomac River by officials of the Bureau of Biological Survey, U. S. Department of Agriculture, and also by individuals. These birds on being examined by pathologists of the department showed a severe inflammation of the intestinal tract caused by intestinal parasites. The biological survey, in announcing the result of the findings of the department, states that it is very improbable that birds in flight are clinically affected by the parasites. The survey points out, however, that the disease among the birds was discovered in this section only a few days ago and that investigations thus far are entirely in a preliminary stage. The specialists of the department are of the opinion that persons eating birds killed on the wing are very unlikely to suffer ill results, but advise that if any birds are killed on the water they be discarded if an abnormal reddening of the intestinal tract is evident.

COMMERCIAL FISHERY NOTES

N. B. SCOTFIELD, Editor

INCREASING SCARCITY OF CLAMS
ON PISMO BEACH

The 1930 census of Pismo clams (*Tivela stultorum*) was made on Pismo Beach in the latter part of November by the California State Fisheries Laboratory. The results of this year's census are even more discouraging than in former years. The population is now so seriously depleted that any untoward circumstances make a dangerous inroad on the remaining numbers.

The winter of 1929-1930 was apparently unfavorable for the survival of young clams, for individuals of the 1929 year-class, constituting the largest set since 1919, appeared in the fall of 1930 in much fewer numbers than had been anticipated. That this was the result of naturally unfavorable conditions and not due to man's activities was indicated by the fact that the rate of mortality for the 1929 year-class was 59 per cent on the beach open to digging and 60 per cent in the area closed to diggings. This heavy loss of individuals of the previous year's set was somewhat counterbalanced by a good set in the summer of 1930. While not as numerous as in 1929, the clams resulting from the 1930 season's spawning comprised the second best set since 1919.

On the other hand, clams older than the 1929 group were exceedingly scarce on the beach, especially in the open area. No legal sized clams were found in this section of the beach and only 2 per cent in the closed portion. In the open area the number of clams older than the 1929 year-class decreased 81 per cent between 1929 and 1930, while in the closed area these clams decreased only 20 per cent. That the high rate of mortality for the older clams was caused by the clam diggers taking illegal sized clams is apparent, for if this great decrease in numbers had been due to natural causes the same death rate should have prevailed in the closed area as in the open district. In the present state of depletion, the taking of small numbers of illegal clams has a very serious effect on the remaining population. Most of this poaching is presumably done by amateur diggers who do not realize the grave consequences of their offense.

It is evident that present protective measures will not increase nor even maintain the numbers of clams on Pismo Beach. The closed area will save the species from extinction, but to bring the

Pismo clams back to commercial importance the entire beach should be closed to all digging for a number of years.—Frances N. Clark, California State Fisheries Laboratory, November 28, 1930.

CHANGES IN MONTEREY SARDINE
FISHERY DESCRIBED

During the fishing season of 1929-1930, Monterey's sardine industry reached one of the dividing points in its development. The months between August of 1929 and February of 1930, so far as fishing methods at Monterey are concerned, saw the virtual disappearance of the familiar lampara net, its substitution by the ring net, the introduction of the purse seine and the purse seine boat, and the extension of the Monterey fishing area considerably farther to the north. In one season methods that had been in steady use for 24 years underwent a more or less complete change.

This revolutionary departure forms the subject of Fish Bulletin 23, recently published, and written by J. B. Phillips of the State Fisheries Laboratory under the title, "Success of the Purse Seine Boat in the Sardine Fishery at Monterey, California."

By photographs, graphs and text, Phillips gives a brief history of changes in gear in the Monterey sardine fishery from 1903, describes the new equipment installed in 1929-1930, explains its use and presents data showing its effect on the industry.

For the purse seine boat this effect is found in greater cruising radius, marked extension of the Monterey fishing area and larger and more dependable catches. Where only two purse seiners fished at Monterey in the 1928-1929 season, as many as 28 operated by December, 1930.

The smaller lampara boats, almost without exception, meanwhile altered their gear by installing drum winches and ring nets, the latter similar in principle to the purse seine. Speed and certainty of operation are factors favoring the ring net over the lampara.

While the big purse seine boats formed only one-third of the craft in the Monterey sardine fleet of 1929-30, they delivered 40 per cent of the catch received by the canneries.

Twenty per cent of the 1929-1930 catch was taken in the area north of Pigeon Point, an area largely exploited by the purse seiners. Phillips finds that the northern section of the Monterey fish-

ing area is showing a higher relative gain in sardine tonnages than the southern section nearer Monterey.

Both to the layman and the man engaged in the sardine industry Philips' report contains interesting and valuable material. Copies of this publication may be had by writing to the California State Fisheries Laboratory, Terminal Island.

LIVE BOXES FOR ABALONES AT MONTEREY

About October 1, 1930, abalone crews at Monterey started to use crates in which to keep abalones fresh for market delivery. These crates are constructed of wood, and most of them are approximately six feet square and two feet deep. They will hold between 20 and 30 dozens of market-size abalones. The crates are kept in the waters where the crews are allowed to take abalones commercially by diving. The live boxes will aid the crews in conforming to the law, which specifies that abalones must be brought in alive and in the shell. It will also enable the crews to go farther away from the home port and tap new grounds. As soon as a crate is filled with these mollusks, it is lowered in the water with a rope bearing a signal float at one end. The part of the load caught first is thus kept fresh until the boat has attained its capacity or is ready to return to port.—J. B. Phillips, California State Fisheries Laboratory, November, 1930.

ALBACORE AT MONTEREY

Monterey experienced a short run of albacore (*Germo alalunga*) during the fall of 1930. About 86 tons of the white meat variety of tuna were delivered to the Monterey markets, of which practically the entire catch went to the San Pedro canneries. The albacore deliveries started on September 22 and ended about October 20. Although practically the entire Monterey deliveries were made by jig boats, there were several live bait boats fishing in the Monterey area which came from San Pedro. How much these boats took directly back to San Pedro with them is unknown as no figures are available in Monterey. The top price was 8 cents per pound. For a time the price dropped to 5 cents, but fishing ceased at this price.

The albacore were reported as having been caught about 15 miles southwest of Point Pinos. The boats bringing in this species at Monterey are the usual jig type of boats used for catching mackerel, rock cod, salmon and the less abundant varieties of commercial fishes. These jig boats are 20 to 30 feet long and have six and eight horsepower engines. Arti-

ficial lures were used entirely in catching the albacore. Six hundred pounds were considered as a very good load for one of these boats.

C. B. Andrews reported (CALIFORNIA FISH AND GAME, Vol. 13, No. 2, pp. 141-142, 1927) the last appearance of albacore near Monterey during the fall of 1926 in quantities to warrant interest. About 60 tons taken from off Point Sur were delivered in Monterey. He also reported the appearance of this fish in the fall of 1925 from notes of W. A. Selle. This was the biggest year for albacore at Monterey, some 194 tons being landed. Delving into the back files of albacore statistics for Monterey, it is found that albacore have been landed at Monterey every year since 1922 with the exception of 1929, although in some years only a few hundred pounds were landed. The catching of albacore in the Monterey vicinity seems to be concentrated in the fall months, usually from September to December. The following table shows pounds of albacore landed at Monterey and Santa Cruz since 1920 (statistics from CALIFORNIA FISH AND GAME) :

Year	Monterey	Santa Cruz
1920-----	----	----
1921-----	----	----
1922-----	236	----
1923-----	149	----
1924-----	420	----
1925-----	387,729	51,575
1926-----	118,563	120
1927-----	1,051	----
1928-----	180	----
1929-----	----	----
1930-----	172,616	346

Albacore have been reported this year as far north as Yaquina Bay in Oregon. The "Pacific Fisherman" first reported large schools close to Yaquina Bay during the latter part of August. Several large specimens were taken incidental to salmon trolling. According to halibut fishermen out of Newport, Oregon, several large schools of albacore were reported 30 miles off-shore a year ago. Ordinarily, the northernmost range of the albacore on our coast is San Francisco. Shifting of warm ocean currents may have much to do with the appearance of the albacore so far north.—J. B. Phillips, California State Fisheries Laboratory, November, 1930.

ANOTHER WOLF FISH TAKEN AT MONTEREY

A wolf fish (*Alepisaurus aesculapius*) was taken in the surf at Monterey on October 12, 1930. The last one recorded as being taken in the Monterey vicinity was on April 5, 1930 (CALIFORNIA FISH

AND GAME, Vol. 16, p. 267). Previous to that time, no wolf fish had been reported from the Monterey region since July 18, 1925 (CALIFORNIA FISH AND GAME, Vol. 11, p. 188). In the August 15, 1930, number of the Service Bulletin (issued by the Division of Fish and Game for its employees), Captain Lipincott of Eureka reported the capture of a wolf fish in Humboldt Bay. The last record of this fish from the Eureka vicinity was in 1892. In spite of the three reports during 1930, the taking of a wolf fish from California waters remains an interesting event.

The natural habitat of this species is at considerable depths in the ocean.

Once this creature is forced too far above its natural strata, its capture is rather easy due to the rupturing of muscular, fibrous and bony structures by the much lessened pressure at or near the surface. The outstanding features of this odd fish are its lance-like body, its large pointed head, the long wolf-like teeth set in huge strong jaws, the comparatively large eyes, the high and long sail-like dorsal fin, the long pectoral fins just behind the head, the large deeply forked tail, and the flange-like epidermal keel along either side of the body.—J. B. Phillips, California State Fisheries Laboratory, November 26, 1930.

LIFE HISTORY NOTES

REMINISCENCES OF A HUNTER AND COLLECTOR

Chase Littlejohn, professional hunter, collector and close observer of animal life in its native haunts, gave reminiscences from his rich store of field experiences on September 4, 1930, before the Section on Scientific Research of the Commonwealth Club of California. His remarks are reproduced in part from notes taken at the meeting.

In the early days waders were so abundant in the tide flats and waters of San Francisco Bay that a stone thrown among them would result in many casualties. When a boy, I sometimes remember going out with a pocketful of stones and killing any number. They were so thick that it was possible to hit them without much skill. Around the present vicinity of Redwood City, I can recall seeing thousands to each flock whirling clear out into the bay. As they pursued their zig-zag course, their dark inconspicuous backs would blend with the landscape. Then in a few seconds they would turn in unison as if in some way mechanically connected, flashing their white undersurfaces and making a grand show of their numbers appearing and disappearing.

I knew a couple of hunters, who after the duck season was over, used to shoot snipe for the San Francisco market. They would skulk up immense flocks when the tide was up and the birds were probing for food in the higher flats. With a double shot they would sometimes kill enough to fill two gunny sacks. One shot a No. 4 gauge, the other a No. 6 gauge gun. Almost always they could fill two sacks with two shots apiece. You can well imagine the number of waders we had in those days!

The ducks were almost as plentiful. We had more ducks in San Mateo County up to the time I was 10 years old than we have in this whole state at present. This seems like an exaggerated statement, but you could go any time during the winter months, look up and down the sloughs or over the marshes and see masses of ducks rafted everywhere.

When only a little fellow, barely able to handle a gun, I went out with my brother. We turned a bend and ahead was an immense flock of teal duck. Something frightened them, but they flew out only a little way and then began to swim back. My brother made one shot with his big gun. The numbers of birds

rising up so surprised him that he failed to fire the second barrel. I picked up 75 ducks. It is hard to believe that so many teal could be killed with one shot.

After pump guns came in and more people went hunting, ducks gradually became scarcer and scarcer. At the present time what a change is found! I think within the next five years quite a few of our ducks will be extinct or practically so reduced as to be of no utility or benefit to hunters.

I have been trying to get a collection of ducks known north of the Panama Canal. I have written dozens of letters addressed to persons from the Atlantic coast to the Philippine Islands. I hope to show people what we had in the days that are gone, and how rapidly we are destroying what remains by not giving them proper protection. So far I have been unable to secure certain ducks that were very common a few years ago.

In 1927, I took care of the Cardinal Gun Club above Colusa. I did so especially to get specimens. Everything was done to attract the ducks, ponds were baited and made alluring. Only some thirty-six ducks were bagged by the whole crowd. The Eureka Gun Club, a two-mile preserve across the highway, had fair shooting. It is now deserted. The best club in the locality was a natural lake. Even this is now deserted. One club above the Marysville Buttes had an enviable reputation for the fine mallard shooting which its members enjoyed. Only one pair was killed last year.

One of the finest breeding grounds we had in the state was in lands formerly owned by Miller and Lux near Los Banos. Gun clubs now occupy the best places in the area. Shortly after the opening of the season, hunters killed all the young birds born and bred in the locality. You can travel for hours and not see a duck. The red head is the only one that is holding its own. Three or four years ago, it was no trick at all for me to find forty or fifty ducks' nests in a few hours' walk. Recently, five of us found but twenty ducks' nests, three were occupied, the balance deserted. The section will soon be depleted and no birds left, because the breeding stock as well as the natural increase is being harvested to the limit. As long as there are ducks to shoot, hunters will shoot them. When they are all gone they will complain because they cannot kill any more.

Our rails are struggling to overcome so many handicaps, it is a wonder any are able to succeed. Closed seasons since 1880 and complete protection since 1915 have failed to give them a new lease on life. Their numbers have been continually restricted by the encroachment of civilization in their homes and the destruction of their feeding grounds. To make matters worse their enemies are on the increase. Red-tailed hawks have taken to a changed diet since the ground squirrels have been nearly wiped out. They fly over the marshes circling until a rail is spied in its cover or where it can be captured by an opportune swoop. I killed four red-tailed hawks crossing my place near Redwood City carrying rails they had just caught off to the hills where they roosted during the night.

Another enemy is the mussel. Accidentally introduced with a shipment of oysters, the plaisted horse-mussel has become very abundant in the San Francisco Bay area. I well remember the first horse-mussel I ever saw. At first I thought I had discovered a shell new to conchology. A few years later I found clusters of the new mussel in many places. It seemed but a short time after this when every little gutter place affording anchorage contained them. Now the banks of the small muddy sloughs which penetrate the salt marshes in every direction are fairly paved with them like cobbles in a street.

It is the habit of the rail to skulk along the edge of the water probing here and there for worms and insects. If the mussels are feeding and sending out tiny fan-like lips to capture prey, the rail, mistaking the lips for worms, drives its bill into the shell. The mussel closes and the rail's fate is sealed. The mussel never lets go and when it dies, it is tighter than ever. I secured a rail not long ago with its bill nearly crushed in two by a mussel clamped on it. The bird was nothing but skin and bone and had starved to death.

It has been my experience in collecting rails for scientific purposes to find only one out of ten rails with all its toes. In many cases, one to three of the toes will be gone. Occasionally, the whole four are missing and big balls a quarter of an inch in diameter have taken their place. I have caught specimens alive dragging a mussel fastened to a toe. Apparently the bird would carry this impediment until the toe broke off.

Several years ago I took a friend out in the marsh to show him the way the rail nested. We found a number of nests that had little downy young. We heard a cheeping as if a bird was in dis-

tress. We found the nest and the old bird rushed off into the tules, the little fellows following after her. All but one, for this fledgling had a mussel on his foot almost as big as he was. The tide was coming in and in ten or fifteen minutes he would be drowned.

There has been some uncertainty in the minds of zoologists whether grizzly bears ever existed in San Mateo County. It is believed that the county was inhabited only by black bears. In my boyhood grizzlies were common around Woodside. The vaqueros took pleasure in lassoing them and bringing them to town alive. After they had tired of the sport of displaying their dangerous playmates, they would slaughter them and ship the carcass and hide by boat to San Francisco. I was about six years old when the last grizzly was brought in. I managed to cut off one of the claws before the animal was shipped away. I have treasured the trophy all these years.

I also have the skull of a grizzly found by some working men several years ago while grubbing out a deep canyon for some milling operations. Apparently, this animal had been shot and had sought the canyon's depths to die. The skull is evidently that of a very large old bear.

During my boyhood mountain lions were present in goodly numbers. It was a common sight to see a lion being brought in strapped to a horse. Lion skins were also common.—Rodney S. Ellsworth, 510 Russ Building, San Francisco, California. October 15, 1930.

CONDORS ON THE SANTA BARBARA NATIONAL FOREST

We were standing on the porch of the lookout tower on Frasier Mountain in the Santa Barbara National Forest. A large bird was soaring some distance away.

"Is it a condor?" said the lookout. The glasses showed two snow white triangular patches under the wings. The wings angled upward with a beautiful upcurving of feathers at the ends. It was a condor!

We were doing some map work covering the Santa Ynez and San Rafael ranges and often saw these great birds—always soaring. Since they are seldom seen very near by I think they are frequently mistaken for turkey buzzards or eagles. We met comparatively few people in the region who knew them.

Only twice during the summer were we close to one. Each time, the bird was about to alight and both parties were considerably startled. The condor reared back frantically with pumping wings but immediately regained perfect composure

—apparently pretending not to have been at all surprised and sailed away without further wing movement.

One individual that I saw trailed his feet as though he were tired holding them up.

Where Sespe Creek cuts across the Popa Topa mountains between ample cliffs, it was my good fortune to see three condors flying in a group. No wilder scene is hardly conceivable than that of these dark, giant forms gracefully weaving about among the great rocks.—R. St. John, United States Forest Service, Berkeley, California.

BLACK-CROWNED NIGHT HERON IN CALIFORNIA

Twenty-four years ago a pair of black-crowned night herons (*Myticorax nycticorax naevius*) was observed to be using a large spreading laurel tree for a roosting place among Alhambra Creek in the city of Martinez, Contra Costa County. The tree is situated along the line of Henrietta Street.

At that time this section of the city was very sparsely settled and with the exception of a few houses and a school near the creek banks, there were no other encroachments of civilization. Plenty of rough fish and turtles thrived in the deep pools along the stream and in the winter time the surrounding fields were generally flooded with water.

The writer, then in his early teens, often observed these water fowls feeding at dusk on the frogs and whatnots in the fields, and many an unsuccessful attempt was made to shoot one with a slingshot. It might also be well to add that under this tree was a favorite spot for settling school-yard fist battles—the main gallery consisted of perching places along the limbs and in the crotches of the laurel. A vivid recollection recalls that gangs of us scallywags made numerous and stony raids on the peace and quiet of this pair of herons.

But times have changed a great deal since then. The district has been settled until it is now practically in the center of the city. Noisy groups of children from the nearby primary school play steadily near the tree throughout the year. At times, members of the street department have trimmed the limbs of the laurel for a considerable height. The pools in the creek have been filled and cluttered with refuse. Not only that, but a small family lived in a temporary cabin under the tree for a number of years.

Recently, the writer observed that a pair of black-crowned night herons still used the tree for a roosting place.

Whether it is the original pair or not is a matter of speculation. No more than three or four of these birds have been seen at a time in the district.

Often at night the familiar *q-u-a-r-k*, the call of these mysterious night feeders, can be heard and they can be seen soaring laboriously over the rooftops before they pass quickly into the dark like lost raiders. It is known that they feed in the marshes that are numerous in this section of the Suisun Bay territory.

I have been unable to find any heron nests in or near the laurel tree.—Earl Soto, December 14, 1930.

SPINY-RAYED FISH, SAN DIEGO COUNTY LAKES

The records of the California Fish and Game Commission will show that a shipment of large-mouth black bass was first planted in Cuyamaca Lake in 1888, by a Mr. Richardson, Superintendent of the Sisson Hatchery, and Mr. W. Lawrence of the Spring Valley lakes of San Andreas. Mr. Lawrence was superintendent of the lakes at that time. Since this first introduction of black bass into Cuyamaca Lake, there has been from time to time other plantings made from this first original plant to other San Diego County lakes with the result that this county now boasts of being or having the best bass fishing in California, if not in the United States. These fish have been introduced into the following lakes: Sweetwater, Moreno, Hodges Upper and Lower Otay, Murray, Grossmont, Lindo, Henshaw, and Wolford lakes, resulting in thousands of anglers visiting these lakes and tons of these fish are caught, affording pleasure and recreation. These lakes are under State sanitary control with sanitary rules enforced. Climatic and water conditions are ideal, with an abundance of fish food as crustaceans, scuds, snails, dragon and may-flies, shiners, small sunfish, chara and many other aquatic plants. Under these conditions these fish attain an exceedingly rapid growth, the fish averaging from 1 to 8 pounds.

Some years ago small-mouth bass were introduced into Escondido Lake, now called Lake Wolford, and had rather a sad ending. The water being low and used for domestic use, it was decided to give this lake a treatment of bluestone or coppersulphate. The parties undertaking this operation, not being familiar with its strength, either gave the lake an over-dose or allowed a barrel to slip and fall into the lake, with the result that all fish life was destroyed. In 1925, this lake was stocked with large-mouth bass and has afforded some wonderful

fishing. The fish having attained a growth from two inches to six and one-half pounds in weight.

At the termination of the San Diego Exposition, The United States Bureau of Fisheries donated a number of species of fish to Deputy Fish and Game Commissioner, Webb Toms. January 6, 1917, Deputy Toms transported sixteen crappie to a small pond at the head of Moreno Lake. Due to the road conditions it was impossible to reach the lake at this time. From this original planting the above mentioned lakes have been stocked. These fish like the bass, have multiplied beyond expectations, with the result that thousands are now caught. These fish afford excellent sport for the fishermen and average in weight from $\frac{1}{2}$ to 3 pounds. They make an excellent pan fish.

Sunfish or bluegill are exceptionally abundant in these southern waters. An old saying was that if one did not drain the bath tub at night, you could have sunfish for breakfast in the morning. Although I shall have to admit this was somewhat exaggerated nevertheless they do afford a great deal of sport for the women and children, being a valuable food and pan fish.

Due to the vast increase of anglers in this country during the past few years, it seems impossible that the lakes can continue to furnish these game fish unless better protection is afforded. Namely, to place these lakes under State Control as to seasons on bass. At pres-

ent they are governed by municipal or private control. District 4 $\frac{1}{2}$, which comprises Imperial and San Diego Counties, does not include a closed season on bass; nevertheless, due to the other species of fish which are protected by State Laws regarding the seasons in which they may be caught, these lakes are not open to the public at all times and only at times when other protected fish may be taken. Special privilege is sometimes granted, with the consequence that other fishermen see these men fishing and a hue and cry arises. By placing the bass under State control, it would eliminate this feeling. Due to climatic conditions, the spawning season of 1928-29 and 30 was late, with the result that thousands of spawning fish were caught. As these fish carry from 2000 to 10,000 eggs at spawning time one can readily see the depletion which will follow under the present conditions. In view of these facts, I should like to recommend a later opening season; also an earlier closed season to protect these fish from extermination in a few years. The present State limit of fifteen bass with none under the nine inch limit providing a shorter season is made, will meet with the approval of the majority of the sportsmen. Otherwise a creel reduction should be made. I would recommend the present limit of twenty-five crappies be reduced to fifteen, with the present limit of twenty-five sunfish to remain unchanged.—Ed. Glidden, San Diego, California.

CONSERVATION IN OTHER STATES

ONE-DAY HUNTING SEASON

A one-day hunting season on pheasants and quail was held November 1 in Douglas County, Nevada, according to a report submitted by J. W. Thornburg, warden at Markleeville, California. It is the first open season, in this county, for these birds in ten years, the report reads.

The pheasant were first liberated in the Carson valley ten years ago by a few farmers and sportsmen in the county. The birds have been liberated in small numbers each year. The first golden pheasants were liberated two years ago.

TURKEYS PLENTIFUL IN MARYLAND

It is interesting to note in the fall issue of the *Maryland Conservationist* that more than 400 wild turkeys were taken in Allegany County during the hunting season of 1929 and that the birds are increasing rapidly in that state. In a report to the State Game Department, Harry R. Kenney, district deputy game warden of Allegany County, said that it was his belief that sportsmen would be favored with one of the greatest hunting seasons for wild turkeys that they have had in years past.

Investigations show that California possesses quite an area of turkey country which is being developed under the general supervision of August Bade, superintendent of the state game farm at Yountville. More than 300 turkeys have been liberated during the past season and these birds are showing great promise of becoming established in our wilds, according to reports of field men.

TO PREVENT WASTE OF GAME

In an endeavor to stop game waste, the state of Washington recently added to its game laws a statute making it punishable offense for a hunter to fail to properly dress, care for and utilize his kill within 24 hours. The law calls for a fine of not less than \$250 nor more than \$1,000.—American Game Protective Association news service.

RAISE WILD DUCKS

Large scale propagation of wild ducks is being carried out in North Carolina for the first time by Joseph P. Knapp, of Mackey's Island, Currituck County game enthusiast, according to a monthly bulletin from that state. Reports show that the enterprise has been surprisingly successful and facilities will be greatly expanded next season. The hatch of

birds, mallards, was 55 per cent of the eggs set or a total of 3556. Only 84 birds were lost. A total of 2000 ducks had been liberated on the island before the end of July and reports show that the birds soon reverted to the wild state. All birds are banded for study purposes.

GAME FARMS PROGRESS IN WISCONSIN

Reports from all sections of the country reveal that the game farm is playing an exceedingly important part in game conservation work. In a most recent bulletin from Wisconsin the following was noted: "Production statistics recently compiled by the conservation commission indicate that 1930 is a most successful year at the state game farm. Nearly 40,000 pheasant eggs were produced this season at the farm which is located in Peninsula State Park in Door County. The pheasant egg fertility this year was 96.56%. In addition to the work with ringneck pheasants, experimental work is being carried on at the game farm with several other species, principally Hungarian partridge, wild American turkeys, sharptail grouse and quail. Besides the birds there are ten deer held in a large field at the game farm and a study is being made of their feed and habits. Similiar studies are being carried on with raccoon, bear, mink, porcupines, coyotes, wolves, badgers, and several species of hawks and owls."

August Bade, superintendent of our California farm at Yountville, also reports that the past year has brought great success.

PLANT FINGERLING BASS IN FLORIDA

Arrangements have been made with the United States Bureau of Fisheries to secure 400 fingerling small-mouth bass from the Federal hatchery to Louisville, Kentucky. These will be sent by special messenger to Tallahassee shortly after the first of November.

Included in the shipment also will be 500 fingerling rock bass.

These fish will be placed in the Wakulla River, Suwannee River, Chipola River and the Wacissa River in Jefferson County. These streams were chosen on account of the fact that the temperature of the water in these streams, and other characteristics, will be more suitable for these species of fish than the water in the southern part of the state.

PROTECTING WILD LIFE OF MAINE

Maine has approximately 439,000 acres of territory devoted to game preserves and wild life sanctuaries, and additions are being made from time to time. These preserves are scattered about the state, on the coast, on islands, in private and semi-public parks and in the big woods. They vary greatly in size from tracts of a few acres to areas containing several townships.

Conservationists agree that the game preserve is the biggest step that can be taken in bringing wild life back to normal, and so it is proving in Maine. When one of our preserves, of about 45,000 acres, was established four years ago, it was practically impossible to find a deer in it. The region is only an easy day's drive from the central part of the state and the game had been destroyed. At the present time, however, it is possible to see game of all kinds during a drive around the borders of the preserve.

The first game preserves in this state were established in 1917, by special acts of the Legislature. Others have been established at succeeding sessions until now there are 38 reserved areas. Bills asking for the designation of certain tracts as game preserves have been very easy to get through, and as a result no definite requirements have ever been set up, until 1929, when an act was passed giving the Commissioner of Inland Fisheries and Game and the Forest Commissioner joint authority to establish game preserves for ten-year periods in the six counties of the state which contain large areas of wild lands.

Two such tracts have already been set aside, one of 89,434 acres in Aroostook County and one of 45,000 acres in Somerset County. In choosing these preserves great care was taken to select regions which are natural breedings grounds for game and are plentifully supplied with food and water coverts.

All game preserves are marked with large metal signs in black and yellow, and are given special patrol attention by the game wardens. Signs are placed at all roads entering the preserves and at points in clearings and open spaces where they may be easily seen. Hunting and trapping are forbidden and firearms must not be carried in the reserved territory.

No distinction is made legally between the seacoast preserves and the forest ones, but in practice the coast preserves become refuges for ducks and other waterfowl. If beaver, otter or other animals pass within the limits of the preserve, however, they are afforded full protection.

WARDENS CARRY BINOCULARS

It seems that down in Alabama the fish and game law violators have been in the habit of carrying field glasses and thus making a get away long before a warden had a chance to get within arresting distance. But now all wardens of the State Department of Game and Fisheries are carrying light but powerful binoculars.

HUNT DEER WITH SHOTGUNS

Deer hunters in New Jersey will fair forth without rifles in their quest for game this year. The state law which prohibits the use of rifles in deer hunting has not been repealed and, as a result the hunters will resort to shotguns.

It is reported that thousands of deer are wounded by buckshot each season in New Jersey and wander into the swamps to die an untimely and painful death. Sportsmen of the state, it is alleged, are desirous of having this law repealed or amended.

Deer season in New Jersey will extend from December 17 to 21.—*Sports Afield and Trails of the Northwoods*, December 1930.

PHEASANTS IN SOUTH DAKOTA

The best pheasant hunting in the United States is said to be found in South Dakota. It is estimated that 2,000,000 ringnecks were killed in the state during 1929, and that a plentiful supply was left for seed. The season lasted 90 days with a daily bag limit of seven birds.—*American Game Protection Association* news service.

SHORTAGE OF PHEASANTS IN MISSOURI

The Missouri game commission reports a shortage of pheasants among commercial breeders the past spring, due to increased demand by state game farms and sportsmen's associations.

This fact should be an encouragement to those who are beginning in the business of breeding pheasants as a business undertaking. The demand for pheasants for breeding and stocking purposes is constantly growing.

Missouri has operated its game farm since 1928, but for the first two years it was merely a refuge. Birds have been encouraged to nest under natural instead of artificial conditions.

INCREASE OF SWAN

Although swans are said to be very slow breeders, since given protection the whistling swan family have increased along the Atlantic coast from less than 1000 in 1916 to approximately

8,000, according to an estimate of Jack Miner, bird authority of Kingsville, Ontario.

This increase is said to have resulted from the strict protection given the birds following the signing of the migratory bird treaty with Canada.

By enticing the swan to the western end of Lake Erie during the migration period, Miner has saved the lives of hundreds of swan which would otherwise have been swept over Niagara Falls. The annual destruction of swan at Niagara has been large in years past.—American Game Protective Association news service.

BEAVERS IN FLORIDA AND CALIFORNIA

The pair of beaver from Pennsylvania which were released in Jefferson County early last spring have raised three young. The beavers were released near Monticello and their activities were noted in this vicinity for a short time. All trace of them was lost for several months. Recently, they were discovered with their addition to their family some ten or twelve miles from the place in which they were released.

The beaver was formerly a native of Florida but the supply was exterminated several years ago.

Because of the advanced irrigation development in this state the beaver is generally considered a detriment. Years ago these rodents were quite numerous in the river districts. It is said that they even existed around the San Francisco bay. The only protection afforded the animals now in California is in the remote districts where little or no damage can be done by stream obstructing activities. It is also said that Florida is not faced with irrigation problems such as ours. They are rarely found in our river territory now.

BEAVER GOES TO PRISON

Inmates of the Colorado State Prison were recently startled by the discovery of a new recruit in the form of a 58-pound beaver, which had taken up his abode just inside the prison walls.

Gamewarden W. W. Ireland was called to consultation and captured the beaver, though only after taking a considerable

beating and being bitten by the animal.—*Pacific Sportsman*, December, 1930.

HUNGARIAN PARTRIDGES IN OKLAHOMA

Sometime during December 100 pair of Hungarian partridges were released in the center of the Harper County Game Farm. These birds were shipped in from Ulm-Donau, Germany, and of course, since this is their initial experiment on this particular specie of game bird, they have high hopes for big returns from the investment.

It is felt that since the Hungarian partridge is so similar to the native birds of Oklahoma that it will easily adapt itself to climatic conditions. It is much like the bob white, being a little larger, but smaller than the prairie chicken.

A consignment of 600 Hungarian partridges, from Czechoslovakia, were received on November 22 by August Bade, superintendent of the California state game farm at Yountville. The birds stood the long trip very well. After a rest period, during which they will be thoroughly examined for health conditions, the birds will be liberated in suitable territory. It will be the third planting of partridges in the past few years.

"RED CARP"

Goldfish, thought to be the descendants of fish that escaped from Belle Isles in a flood 17 years ago, are caught in commercial quantities and food sizes in the Great Lakes, according to a statement by the Michigan Department of Conservation.

These fish were first apparent in quantity in the Sandusky Bay region in 1920. The fish are now taken in large numbers by commercial fishermen who haul seines in Lake Erie.

The larger specimens are sold for food on the market and are known as "red carp." Others are sold alive for stocking private garden pools.

These fish are much larger than the fish ordinarily seen, generally attained weight of from one to two pounds, as compared with goldfish confined in bowls or small aquaria which seldom attain any considerable growth.—Washington, D. C., *United States Daily*.

DIVISION ACTIVITIES

Bureau of Patrol

Fred Herman, volunteer deputy, was appointed to special duty on the Shasta River in connection with salmon experiments being conducted by Dr. Snyder of Stanford University.

During the month of September a total of 295 arrests were made and 345 fines were imposed for a sum of \$11,755. For a like month in 1929 a total of 276 arrests were made which brought a sum of \$9,382.

In October the deputies made 266 arrests which brought 213 fines for a total sum of \$7,840. During the same period in 1929 the deputies made 251 arrests and brought fines aggregating \$8,420.

Five arrests were made in 1929 in October for using illegal nets in San Luis Bay. These men were fined \$125 each. The case was appealed to a higher court, which affirmed the Division. The fine of \$625 was paid in October this year.

During November the deputies made 237 arrests, 195 fines and the state collected \$6,290. During the month of November, 1929, 253 arrests were made with fines totaling \$8,332.

Bureau of Commercial Fisheries

All the sardine plants at Monterey operated during the month of September except the Bayside Fish and Flour Company, which closed as per agreement, and the Monterey Sardine Products Company.

The quality of the sardines taken was a little better than during August, but most of the catches made within Monterey Bay were soft on account of "green feed." The fish continued to carry a high percentage of oil.

The State Board of Health had an inspector at each plant and were very strict in passing on the quality of the fish. In regard to the "green feed," the State Board of Health did not condemn the fish but required that the fish be thoroughly cleaned.

There was trouble over the price of the fish, and on September 23rd the fishermen went on strike and were out until Sep-

tember 30th. The strike included fishermen at San Francisco.

In spite of these drawbacks, there were taken at Monterey and Pittsburg during September 21,620 tons of sardines—this is an increase of 1777 tons more than were taken for a corresponding period last year.

There were packed in the same district 243,552 cases of sardines which is an increase of 7710 cases over the same period last year.

There was produced during September 623,051 gallons of sardine oil, an increase of 158,936 gallons over the same month last year. They averaged 42.7 gallons for each wet ton of material used in the reduction plants.

During the month the commission issued General Order No. 11 for the regulation of sardine canners, reduction plant and packers of other sardine products. This order consisted of four regulations: the first three to facilitate checking the receipt of fish and amount of pack at the different plants. Regulation No. 4 was made at the request of the State Board of Health, and provides that only sardines which are fit for human consumption can be received at canning or reduction plant. This order was served on all sardine plants and fishermen's organizations at Monterey, Pittsburg and San Francisco on about September 23d.

On September 6th, the salmon season on the Klamath River closed and the commercial catch of salmon was about double that of 1929. The cannery packed 10,344 cases of salmon as against 5253 cases last year. It is believed that this increase was due mainly to the small amount of sea trolling carried on during the summer.

The season on the Sacramento River closed on September 17th and it was reported there was a phenomenal run of salmon on the river.

Two salmon trolling boats, going from Eureka to Monterey, caught about 600 pounds of albacore, which were delivered at Monterey on September 22. Two of the fishermen from Monterey caught about 500 pounds of albacore about 10 miles outside of the bay. This catch created a great deal of excitement a

all of the local salmon boats, and some of the lampara boats, started out to troll for albacore—as high as eight tons per day were caught, and a bait boat was sent up from San Pedro to buy and transport these fish to the canneries at that port.

Three lampara boats at Monterey brought in 20 tons of horse-mackerel each during September.

On September 15th, Capt. H. B. Nidver was transferred to Monterey to take charge of the patrol boat "Albacore." He was transferred later in the month to the San Francisco district,

boats which operated outside the bay brought in better fish.

The amount of sardines received at Monterey and Pittsburg for October was 33,830 tons, as compared with 35,401 tons for the same period the previous year.

During October the "Bluefin" was kept busy on patrol, mostly near the lobster grounds previous to the opening of the season. Many baited traps were found and destroyed. On October 8, it overhauled a boat owned and operated by two Santa Barbara fishermen, on board of which was found 1200 pounds of spiny



FIG. 37. Salmon weighing 59 pounds caught in the San Joaquin River in shad nets near Pittsburg, California. Photo by E. S. Cheney, April, 1929.

where he has taken charge of an intensive campaign to straighten out the boat registrations and the fish receipts in northern California, in order to get them in shape for installing a punch card system for handling the fisheries statistics.

Captain S. H. Lyon, of the game patrol department in charge of the Sacramento district, was detailed to Terminal Island in September to take charge of the Commercial Fisheries Patrol and inspection of canneries.

Sardines were fairly abundant in October but there continued to be trouble with the "green feed" in the fish caught within Monterey Bay. Purse seine

lobsters; as the season for possession of lobsters would not open for another week, the men were arrested and pleaded guilty before the justice. Each was fined \$300.

During October there was a rush of salmon at the Shasta counting rack. The water was for a time too muddy to count the fish through sight so workers resorted to dipping the fish and placing them above the rack. Although for a time the men put over a thousand salmon per day above the rack, the fish accumulated in considerable numbers below the rack and this caused a great deal of complaint on the part of those who believed the rack was destroying the fish.

Dr. J. O. Snyder, of Stanford University and who is conducting the salmon investigation, made several trips to the river to quiet the fears of those who thought the rack was destroying the fish. After the water had cleared the men opened the rack so as to permit them to count the salmon quickly and accurately.

Mr. Brown, stationed at the Shasta rack, reported that up to November 3, they have counted, through the rack, 19,889 fish. These were composed of 7524 chinook salmon, 12,012 grilse (chinook salmon), 314 steelheads and 39 silver salmon.

During October, Fish Bulletins Nos. 23, 24, 25 and 26 were received from the State Printer. Bulletins Nos. 27, 28 and 29 have been completed and are ready for the printer. The third of a series of yearly catch bulletins, which is for the year 1929, is ready for the printer.

During the month of November, 18,819 tons of sardines were received at Monterey and Pittsburg, as compared with 25,867 tons in the same month last year.

The tuna canners and fishermen have been catching and canning a great many tuna during the month of November, and this industry, along with a number of others, is threatened with overproduction.

M. J. Linder resigned from the bureau laboratory during the latter part of November in order to accept a position with the United States Bureau of Fisheries. John Terry reported for work on November 10.

The annual clam census at Pismo Beach was made on November 19, 20 and 21. E. C. Scofield came down from Monterey and three staff members from San Pedro were present: Frances N. Clark, G. H. Clark and W. L. Scofield.

The extraordinarily high record of 94 per cent convictions in court cases involving California lobster law infractions was established from the first of January, 1930, to an early date in December of the same year, according to records of the patrol department of the Bureau of Commercial Fisheries.

Out of a total of 34 cases taken into court during this period, convictions were

reached in 32 cases. One case was dismissed and another was settled through a verdict of not guilty. Fines totalling \$1520 were imposed by Southern California judges.

In numerous instances deputies confiscated catches of under-sized or out-of-season catches. Here it was impossible to apprehend the guilty.

A bald recital of court decisions, at the same time, fails to give a complete picture of the patrol department's activities in enforcing the law. In accordance with its policy of friendly cooperation with fishermen, the patrol force had occasional time after time to warn lobster fishermen and explain the law to them without resorting to arrest and trial.

The patrol boat *Bluefin* changed her headquarters from San Pedro to Monterey for a time in December, 1930, to take over the work of the *Albacore* in general patrol and research work on Monterey Bay. During that period the *Albacore* was detailed to observe activities of the floating reduction plant "Lak Miraflores."

According to her log records, the *Albacore* first sighted the "Miraflores" on November 26, six miles southwest of Point San Pedro. Two purse seiners, the *Am bassador* and the *Emperor*, were fast alongside the reduction ship.

An exceptionally good season in 1929 was succeeded by a relatively poor season in 1930 in the San Francisco shrimp fisheries, reports show.

The California shrimp fishery is the subject of a survey on which Paul Bonno has been at work.

Ward T. Bowers, chief of the Alaska Division of the U. S. Bureau of Fisheries visited the California State Laboratory at Terminal Island early last December. Prior to his visit he had inspected the fisheries along the Gulf of Mexico.

Data for the latest catch bulletin prepared by members of the Commercial Fisheries Bureau went to the state printer last November for publication. The bulletin will present monthly and seasonal catch totals for each variety of fish for each California port in the year 1929. These tables will be accompanied by graphs showing catch trends, by explanatory texts and by a number of special articles.

Bureau of Finance

County clerks have remitted on the 1930 series of licenses since January 1 and ending in October the following amounts: angling \$109,757, hunting \$28,003 and deer tags \$3428. This is a total of \$141,188.

Total license sales and miscellaneous collections by the division in September amounted to \$24,173.67.

From all indications the total sale for the year will be about the same as the sale for 1929.

For the period ending November 30th, the total amount of remittances from county clerks to the State Controller for deer tags was \$96,218.

From all indications, the hunting license sales for 1930 are not holding up as well as the sales in 1929. It appears that the sale of the 1930 series of angling licenses will show a slight increase over the 1929 series.

Bureau of Fish Culture

The number of fish planted this season up to and including September totaled 36,313,345. Fish on hand at the hatcheries on September totaled 4,215,474.



Fig. 38. Trout from Willow Creek, Lassen County. The main problem involves getting all these big fish into the one creel. Photo by E. S. Cheney, May, 1928.

During the present year, the majority of county clerks have been quite prompt in making their quarterly reports and remittances.

About the 15th of November the state printing plant delivered the 1931 series of hunting and angling licenses. The value of licenses received amounted to hunting licenses \$769,000 and angling \$691,000.

The only reason requiring the distribution of the hunting licenses at this time is for the fifteen days remaining of the duck season in January. The licenses will not be found useful again until the month of August.

The number of fish planted during the month totaled 6,317,249.

George A. Coleman made a study of the fish in Lake Tahoe during September. Specimens of native Tahoe trout, steelhead, eastern brook and mackinaw trout were obtained. He also made studies at the Brookdale hatchery and at the end of Elkhorn Slough in Monterey County.

About 1800 good sized striped bass were delivered and successfully planted in Salton Sea in October. This planting was a continuation of the work started in 1929.

A survey was made of conditions in the Klamath River by Mr. Coleman. A collection of the larvae of the different species of salmon flies in the Klamath River was made by employees of the Mt. Shasta hatchery.

Experiments were started in October at the Brookdale hatchery to determine the effect of the exhaust gases from out-board motors on fish life. Results obtained in November were negative.

The total number of fish shipped or planted for the season up to and including October is 38,804,944.

An experiment was carried on at Brookdale hatchery to test the use of dried animal blood as a fish food. Too much objection was found to its use on the part of the trout to make it advisable to try this product out in its crude form on a large scale.

A survey was made of the condition of the young trout fry being held in cement ponds and pontoon cages in certain San Diego County lakes. It was found that the brown trout are doing fairly well, but the rainbow are now rapidly dying off.

An experiment was carried on in securing and the transportation of ghost shrimp and mud-fish from San Diego bay to Salton Sea and planting the same. About 15,000 ghost shrimp and 500 mud-fish were successfully planted with very little loss.

A survey of conditions was made in November on Lake Elsinore. They were found to be excellent—the bass, bluegill, carp and catfish are all apparently prospering.

Early in November creeks along the coast route from San Diego north to San Francisco were found to either be bone dry or to carry very little water. A survey was also made of creeks in the vicinity of Chico and only one, Chico creek, has a steady flow of any appreciable size.

The number of fish shipped or planted for the entire season, up to and including November, totaled 39,774,293. Fish shipped and planted during November totaled 969,349.

Bureau of Education and Research

Members of the bureau assisted in various details relative to the fish and game exhibit at the State Fair in September.

Approximately a dozen lecturers were given to schools, clubs, universities and other organizations in the months of September.

E. S. Cheney made a trip to southern California where he secured his first motion pictures of mountain quail. His attempt to register the condor was unsuccessful as the great birds would not approach close enough to the blinds.

With the opening of the schools, films were much in demand during September and twenty-seven different organizations used the division reels.

Dr. Michael Hobmaier, new division pathologist, arrived from Germany in September and started to work immediately on the duck disease problem.

E. L. Summer, Jr., continued censuses of water birds at the Los Banos duck refuge. A complete record of all species seen, with relative abundance of each, is being made each month.

A questionnaire as to the use of poison in pest control has been prepared and was mailed to more than 4000 persons during September.

Gordon H. True, Jr., was appointed to serve on the Game Depredations committee of the State Chamber of Commerce.

Much work was done during September with repellents for the deer damage problem.

An attempt is being made by the library staff to secure a complete file of laws regulating the importations of birds and animals in various states. Also research work is being conducted in an attempt to compile complete information on the effect of thallium poisoning on humans and the extent to which that poison is being put in use in the different states. A third program investigated is that of plague in muskrats.

E. S. Cheney spent the greater part of October securing pictures of duck and goose shooting in Lassen County. He has also completed two additional reels on the bird life of the Los Banos refuge.

Dr. M. Hobmaier and Paul A. Shaw made a trip into northern California where they made a study of duck disease. Dr. Hobmaier also made trips to Jordan Game Farm near Woodland where he investigated a disease among pheasants.

ber, November and December. Lectures illustrated with the division's latest pictures were displayed before high schools and grammar schools, service clubs and other organizations. The bureau's representative, Rodney S. Ellsworth, gave a total of 28 lectures and reached more than 6100 persons with a message of the significance and value of wild life conservation. Though the audiences as a whole were small, they were representative of the foothill and mountainous dis-



FIG. 39. Young redtail hawk. Taken on State waterfowl refuge near Los Banos. Photo by E. S. Cheney, May, 1930.

Donald McLean made investigations of deer damage to grapes between Gilroy and Watsonville.

Considerable time was spent in October by the library staff in compiling information on importation of exotic wild and domestic birds and animals, outbreaks of plague, thallium poisoning with respect to human beings eating birds and animals killed therewith.

The Mother Lode country from Nevada City, Nevada County, to Sonora, Tuolumne County, was covered during Octo-

ber. One of the most important engagements was at Auburn on October 15. Three service clubs and the Placer County Public Anglers' Association met for a cooperative dinner and the division's pictures preceded by a talk by Ellsworth on "Game Management" were one of the features of the evening.

During November an excellent picture was taken of mountain sheep in Inyo County by E. S. Cheney.

Donald McLean, field naturalist, made a trip to San Bernardino and Los Angeles on quail refuge investigations.

Bureau of Game Refuges

Work on the Button Willow refuge for elk was started in September. About 300 acres were fenced during the month and work started on herding the animals into the enclosure.

At the Los Banos refuge water conditions were satisfactory in September and by the end of the month thousands of birds were present. Experience through the summer proved that the location is right and that water conditions will be satisfactory. The present year has been the dryest for many years in the San Joaquin Valley.

Nineteen mountain lions were turned in for bounty during September. These were killed in the following counties: Trinity 5, El Dorado 4, Shasta 2, and one each in Monterey, Tuolumne, Santa Clara, Santa Barbara, Humboldt, Madera, Mendocino, and Del Norte. Lion hunter Bruce, working in El Dorado County, killed 4 and Ledshaw, in Shasta County, got 2. The kill is practically the same as the kill of September a year ago when 16 bounties were filed.

During November water was being delivered to the water fowl refuge from four supplies. Ducks and geese certainly found the area a haven during the month. It is interesting to watch the birds work into the refuge on shooting days. There has been difficulty with poachers during the month.

Twenty-two mountain lion claims were filed during October. This is the largest number since April. These lions were taken in the following counties: Trinity 5, Lake 3, Shasta 3, Tulare 2, El Dorado 2, and 1 each in Sierra, Inyo, Fresno, Plumas, Monterey, Del Norte and Santa Barbara. For the year so far, 235 claims have been filed—131 females and 104 males, as against 271 for the corresponding period last year, 155 females and 116 males.

The 1930 deer killed from a compilation of returned deer tags amounted to 24,131 bucks. This is an increase of nearly 14 per cent over the kill of 1929, and of 12 per cent over 1928, and of 23 per cent over 1927. It is interesting to note that the proportion of two, three and four-point bucks has remained practically constant during the four years the tag system has been in effect.

Mendocino is the leading county with a report of 1483 deer, Siskiyou follows with 1372, Modoc 1129, Tulare 965 and Humboldt 917. In Los Angeles County 637 deer were reported as against 691 for 1929, 369 for 1928 and 425 for 1927. On the whole the returns show a healthy condition throughout the state.

Mountain lion hunting was considerable better in November. Thirty-one lions were turned in for bounty—19 females and 12 males. This brings the total for the 11 months of the year to 268—only 20 short of the corresponding period last year. Nine lions were killed by our own hunters. The lions killed were taken in the following counties: Trinity 5, Amador 4, Humboldt 3, Glenn 3, Colusa 3, Monterey 2, Ventura 2, and one each in Tehama, Kern, Fresno, Tulare, Mendocino, Lake, Siskiyou, San Luis Obispo and El Dorado.

Bureau of Hydraulics

Recent court cases filed for oil pollution of San Pedro Harbor have very materially helped in improving conditions there.

A report of dead salmon and steelhead being found in the Klamath River, in September, was investigated for the purpose of determining the cause.

In October San Pedro Harbor continued to show signs of improvement with respect to oil pollution.

Complaint filed by Deputy F. J. McDermott for lime pollution of a creek near Santa Cruz resulted in a \$200 fine. This was suspended and no further pollution is expected.

In November the San Joaquin Light and Power Company completed a good concrete fish ladder on the Merced Falls Dam on Merced River.

The Quincy Lumber Company have constructed a fish ladder at their mill pond at Sloat.

The sanitary district of San Joaquin County desires to hold water above the Woodbridge Dam on the Mokelumne River for the purpose of keeping the mosquito fish alive and thus abating the mosquito nuisance. To make this possible it will be necessary to make changes

and improvements on the fish ladder and money has been provided for this work by local contribution. The bureau has assisted and the money has been collected and the work will start shortly.

The Pacific Gas & Electric Company has made improvements on the Silver Lake fish ladder.

Improvements have been made on the Clough Dam and fish ladder.

Bureau of Game Farms

The Yountville game farm furnished exhibits of game birds and game farm equipment for three large affairs during the month of September; and the Los Serranos game farm exhibited similar work at two large fairs. Sacramento, Marysville, Bakersfield, Pomona and Riverside were the cities in which exhibits were made.

Attendants at these fair showings report an increased interest by the public in all matters pertaining to game birds and their propagation. Many more people are able to call birds by their correct names, and seem to know more about their general habits and usefulness than was the case a few years ago. Judging by the number of requests for exhibits, many of which we cannot fill, and the number of inquiries from private individuals for information as to propagation methods, it would seem that much real interest is being taken in this work.

At the recent meeting of the Western States Fish and Game Commissioners at Santa Fe, New Mexico, most of the papers read and the speeches made paid special attention to education and research, and it was interesting to note that California was mentioned as the leader in this work. In the matter of artificial incubation and brooding of game birds, but one of the eleven western states offered any competition to the program that California is carrying on—that state was Utah.

Development work was started in September at the Los Serranos game farm to get the place and equipment up to standard for higher production. It is planned to do this work with the regular force during the fall and winter. Breeding pens, watering system for lawns and additional brooding houses are included in this program.

The planting of game birds continued systematically during September and many new places were discovered for the work.

While in New Mexico August Bade, game farms superintendent, made arrangements for the introduction of new turkey blood for our flocks. This will be done by getting wild trapped birds and taming them for use in the breeding pens. Both New Mexico and Arizona have promised to help in this work. They want our system of hatching and brooding pheasants and other game birds, and we want their turkeys, so it was not difficult to come to an understanding.

Plants of birds were made at Indian and Sierra valleys in Plumas County for the first time in October. Antelope Valley, Mono County, received a second planting. Some foundation breeding stock of turkeys was given to Mono County for future work.

A turkey refuge is being planned in the Mt. Lassen district and will be stocked later in the year. There are a few turkeys in this district from an original planting made about fifteen years ago. A checkup on the turkeys in Mariposa made in October shows that the birds are doing very well, despite some reports. We found the birds nine miles from the original planting ground in a district where conditions seem very good. A letter from a Los Angeles man indicates that some of the turkeys planted in Humboldt County are doing well. He said that he came upon a flock in the wilds and wondered where they came from. A similar report gives an account of a flock of thirty turkeys found in Mt. Shasta National Forest; these birds are more than 50 miles from the original planting ground.

The two game farms produced 350 fine turkeys this year and our schedule for the future will probably increase that amount to some extent.

A new section of breeding pens for the Los Serranos game farm was built in October. It is planned to transfer two of our experienced men to the Los Serranos plant for a month in order to speed the work.

The need of some sort of control over the private breeders of the state is more evident every year. Most of these places,

due to congestion, are simply breeding places of disease. The breeders themselves suffer greatly from such a condition. We strongly recommend that steps be taken to get these places on a better basis. Standard-size equipment and inspections will help to solve the problem.

During the month of November, 580 pheasants and 105 turkeys were released for stocking purposes. The pheasants were planted at Victorville and Reseda in the southern part of the state, and at Arcata, Ferndale, Spalding Ranch, Gilroy and Santa Cruz. Turkeys were released at Big Meadows and Santa Ysabel in the south, and in Humboldt and Plumas counties in the north.

Twenty pairs of California valley quail were shipped to Montana in November in exchange of fish eggs received last spring from the Montana Commission.

The shipment of Hungarian partridges arrived from New York on November 23d. These birds came through in good condition. Exactly 643 birds left New York and 631 arrived here alive. The birds are penned in quarters that had been specially prepared for their reception—there is plenty of growing feed (greens) in the pens. We expect to liberate these birds after the first of the year.

Reports received in November on the plants of birds last year indicate that they are making fine progress and we feel sure that if protection is given them it will be only a few years until California will have the partridge in well established numbers. We are also giving special attention to the Chukor partridge (of India) as an additional partridge that we believe will fit into our plan of restocking. These birds will take to wooded sections and that is the territory that needs help in our state. With Chukor partridges, wild turkeys and Reeves pheasants for the higher elevations, these regions should take on additional life and balance the hunting activities in the agricultural sections.

We have another hundred pens well under way at the Los Serranos game farm and this will greatly increase the activities in southern California. All the work is being done by our forces. In this way we get the sort of work that best fits our needs, and at a minimum cost.

Volunteer Deputies

During the month of September the volunteer deputies did very good work in checking deer hunters and anglers in the mountain districts within the state, and in investigating reported cases of illegal killing of does, fawns and spike bucks. Working in cooperation with the regular patrol these deputies made a number of arrests in which cases fines in excess of \$1,000 were imposed.

During September the volunteer deputies were active in establishing quail sanctuaries, in which work they met with spontaneous and harmonious cooperation and support of farmers and landowners in all parts of the state.

The following report received in September from Acting Forest Supervisor R. H. Blood, of the Sierra National Forest, California, will indicate how the quail sanctuary and game refuge work is progressing: "At a rough estimate, I have already received pledges covering between 300,000 and 400,000 acres, most of which is foothill country where quail abound under normal conditions. I trust that this attitude on the part of the settlers will convince the Fish and Game Commissioners that we are now in a position to protect Hungarian partridges or any other birds that may be planted in the Forest."

In the Tehachapi mountain section of the state the volunteer deputies have succeeded in having 15 of 45 sections which cover the Fickert Ranch, set aside as quail sanctuaries. The Tajon Cattle Company, Hill Bros., and the owners of other large tracts of land in that section of the state have also set aside certain parts of their land as quail sanctuaries in about the same proportion, and will issue permits to sportsmen to hunt on surrounding territory.

Reports from the volunteer deputies for the month of September indicate that quail have had more and better consideration from the out-of-door public this year than in past years. This has resulted in better breeding and the rearing of large coveys. In many cases the birds reared a second and a third brood of young.

From present indications it appears that the movement for the establishment of quail sanctuaries by the farmers and landowners on their lands, under the plan suggested by the commission, is being met with the unanimous and harmonious cooperation and support of farmers and sportsmen in every section of the state. The general opinion and expression seems to be that it is one of the best moves that has ever been undertaken to reestablish the supply of quail, and that it will prove to be an unquestioned success.

Noticeable among the activities on the part of volunteer deputies in October are those of deputies I. O. Burton of Redlands, who in coordination with regular Deputy R. Little, made fifteen arrests for violating the dove, quail and shore bird

law (in which cases fines aggregating \$415 were imposed); and Deputy F. Kiesling of McCloud who, unassisted, arrested a man he apprehended in the field killing a doe deer—a fine of \$150 was imposed.

Volunteer deputies held a meeting on October 6 at Tehachapi, Kern County. This meeting was held in connection with a meeting of the Tehachapi Fish and Game Protective Association and was attended by about 40 volunteer deputies and members of the association. Many of those present traveled more than 50 miles to attend the meeting.

As upwards of 450 sanctuaries have been established by the end of October, it is safe to say that a goal of 500 will be reached by the end of the year.

REPORTS

SEIZURES OF FISH AND GAME

July, August, September 1930

alone	687
crayfish, pounds	3,159
fish, striped	192
fish, black	28
fish	1,455
fish	42
fishers	458
fishers pounds	160
in traps	36
mon	28
net, nets	1
fish, perch, crappie	489
fish croaker, pounds	42
hunting	1
out	349
er	109
er meat, pounds	416
er hides, heads, horns	7
ves	1,146
cks	6
ese	3
n-game birds	8
ail	41
bbits	25
rebirds	1
ups, bird	2
irrels, tree	3
re hens	11
ir Hide	1

GAME CASES

July, August, September, 1930

Offense	Number arrests	Fines imposed	Jail sentences (days)
hunting License Act; violations of	74	\$1,604 50	100
er; killing does, fawns, spike bucks; closed season; no deer tags	154	8,420 00	28
er hides; closed season	2	25 00	-
ves; closed season; overlimit	67	1,632 00	20
cks; closed season	6	190 00	-
ese; closed season	3	25 00	-
n-game birds; killing of	7	75 00	5
ail; closed season	22	555 00	4
bbits; closed season	17	243 00	27
d traps, nets; illegal	2	95 00	-
irrel; closed season	2	25 00	-
re hens; closed season	3	30 00	10
ir; closed season	1	10 00	-
asants; closed season	3	235 00	-
eons; closed season	2	5 00	-
hunting in game refuge	32	1,475 00	-
ht hunting	10	290 00	5
ooting from automobile	9	175 00	50
spassing	1	25 00	-
buse; closed season	1	-	-
mmercial Gun Club License Act	1	25 00	-
Totals	419	\$15,164 50	249

FISH CASES

July, August, September, 1930

Offense	Number arrests	Fines imposed	Jail sentences (days)
Angling License Act; violations of	57	\$1,176 00	2
Abalones; small, overlimit	23	833 00	
Barracuda; small	7	200 00	1
Bass; striped, overlimit, small	34	1,031 00	8
Bass; black, small	3	20 00	
Clams; overlimit, small	48	1,195 00	9
Crabs; small	4	120 00	
Lobsters; closed season	13	1,325 00	
Commercial Fishing License Act; no license	36	372 00	
Crappie; perch; sunfish; closed season	6	160 00	
Salmon; closed season, spearing of	2	200 00	
Seine, nets; illegal	18	825 00	18
Trout; closed season, overlimit	18	320 00	
Illegal fishing apparatus	3	35 00	
Pollution of bay, streams	5	250 00	
Night fishing	1	50 00	
Dynamiting fish	1	200 00	
Fishing too near dam	2	25 00	
Miscellaneous	1	5 00	
Totals	282	\$8,342 00	38

HUNTERS KILLING TWO DEER—1930

County of residence	Number of hunters	County of residence	Number of hunters
Alameda	157	Riverside	5
Alpine		Sacramento	6
Amador	10	San Benito	3
Butte	51	San Bernardino	3
Calaveras	23	San Diego	2
Colusa	37	San Francisco	11
Contra Costa	38	San Joaquin	3
Del Norte	11	San Luis Obispo	9
El Dorado	55	San Mateo	3
Fresno	113	Santa Barbara	8
Glenn	34	Santa Clara	7
Humboldt	125	Santa Cruz	3
Imperial	7	Shasta	5
Inyo	31	Sierra	
Kern	76	Siskiyou	11
Kings	10	Solano	3
Lake	31	Sonoma	11
Lassen	9	Stanislaus	3
Los Angeles	304	Sutter	1
Madera	23	Tehama	6
Marin	44	Trinity	2
Mariposa	10	Tulare	8
Mendocino	98	Tuolumne	1
Merced	13	Ventura	3
Modoc	3	Yolo	3
Mono	4	Yuba	1
Monterey	81	Missouri, state of	
Napa	46	Nevada, state of	
Nevada	17	Oregon, state of	
Orange	43	Washington, state of	
Placer	36		
Plumas	30	Totals	2,90

DEER KILLED IN CALIFORNIA

	Deer killed, 1927	Deer killed, 1928	Deer killed, 1929	Deer killed, 1930	Land area square miles
ameda	220	263	275	252	783
ine	67	66	89	124	776
ador	59	78	87	101	601
ie	228	212	234	314	1,698
averas	149	191	175	283	1,027
usa	263	272	297	343	1,140
tra Costa	5	6	14	6	714
Norte	42	48	55	40	1,024
Dorado	535	548	597	685	1,737
eno	592	763	764	893	3,950
nn	623	592	586	601	1,337
mboldt	821	777	689	917	3,575
perial	1	4	4	1	4,089
o	173	239	253	251	9,991
on	218	295	297	324	8,003
ngs	3	3	3	12	1,159
ce	901	1,038	841	885	1,238
ssen	296	393	511	585	4,531
Angeles	425	369	691	637	4,115
dera	260	300	313	379	2,112
rin	367	444	394	403	529
riposa	95	134	144	235	1,463
ndocino	1,475	1,468	1,355	1,483	3,539
rced	67	68	48	68	1,995
doe	510	729	835	1,129	3,823
no	36	55	76	73	3,030
nterey	757	830	734	864	3,330
pa	442	569	523	536	783
vada	125	140	169	236	974
unge	56	69	81	90	794
cer	341	346	335	340	1,411
mas	551	586	695	764	2,593
erside	323	249	404	629	7,223
ramento	0	2	0	2	983
Benito	217	320	269	313	1,392
Bernardino	74	122	120	188	20,175
Diego	169	232	233	250	4,221
Francisco	0	0	0	0	42
Joaquin	21	14	22	22	1,448
Luis Obispo	394	450	455	568	3,334
Mateo	77	89	102	100	447
ta Barbara	669	851	717	777	2,740
ta Clara	397	536	577	650	1,328
ta Cruz	78	92	102	115	435
sta	612	603	702	655	3,858
ra	101	102	132	137	923
ciyou	1,665	1,654	1,211	1,372	6,256
ano	45	52	54	58	822
oma	751	753	732	865	1,582
nislaus	91	115	119	111	1,450
ter	1	3	2	1	608
ama	799	846	758	845	2,925
nity	921	800	751	760	3,096
lare	744	939	807	965	4,856
olumne	213	213	212	280	2,190
atura	274	362	346	308	1,878
o	115	169	176	214	1,014
ba	53	52	55	93	632
Totals	19,507	21,515	21,292	24,132	155,672

STATISTICS ON DEER KILL, SEASON 1930

County where deer was killed	County of residence of hunter																			
	Alameda	Alpine	Amador	Butte	Calaveras	Colusa	Contra Costa	Del Norte	El Dorado	Fresno	Glenn	Humboldt	Imperial	Inyo	Kern	Kings	Lake	Lassen	Los Angeles	Madera
Alameda	190	3	9		15		15			1	1								1	
Alpine	14		45		3		1												3	
Amador	12					2	6		1										1	
Butte	8		236			9				3									5	
Calaveras	9		6		139	24				5	8				1		6		2	
Colusa	17					156	6			1									3	
Contra Costa																				
Del Norte								30				9								
El Dorado			34			3	7		324	3					2				1	
Fresno	29						4			555					33				8	6
Glenn	8									1	156	620			4				19	1
Humboldt	33		47			60	10			1					3				20	
Imperial	50				1		9	1											42	
Inyo	2													127	7					
Kern															197				84	
Kings															2				89	
Lake	103					46	43			6	3	1		3	4	3	223		24	
Lassen	27		1			14	9		2	8	9	1			6	3	10	163	29	
Los Angeles															7				567	
Madera	7									116				1	9	5			41	137
Marin	19														2				1	
Mariposa	11						3			9									9	23
Mendocino	150		11			3	45			7	14	19	1		3		7		50	
Merced										2					1					
Modoc	41		22			26	21			19	29	14	3	24	4	6	52	12	45	2
Mono	1																		19	
Monterey	15						2			13					4	2			31	
Napa	49						12			1					1	1	2			
Nevada	11					1	3													
Orange																			3	
Placer							6												19	
Plumas	13								22						9				25	
Riverside	41		59			4	14			2	8						3	44	36	202

[illegible]

San Benito.....	1	5	31	1	15	22	104	107	1	8	13	420								
San Bernardino.....	1	5	16	1	31	2	2	5	1	42	2	38								
San Diego.....	1	4	1	1	2	10	15	2	10	26	1	1								
San Francisco.....	1	4	10	1	12	7	8	2	8	1	2	2								
San Joaquin.....	1	4	10	11	4	1	22	1	5	6	13	1								
San Luis Obispo.....	1	4	21	2	8	1	8	1	2	129	5	5								
San Mateo.....	1	4	19	2	13	8	20	2	4	45	13	2								
Santa Barbara.....	1	4	9	2	8	8	15	1	9	48	4	3								
Santa Clara.....	1	4	4	30	3	4	1	16	3	1	1	2								
Santa Cruz.....	4	2	1	3	30	2	2	2	1	5	24	3								
Shasta.....	4	4	10	11	4	2	2	2	2	1	1	1								
Sierra.....	4	4	15	1	1	2	14	10	1	6	1	2								
Siskiyou.....	3	4	2	3	3	2	10	2	2	2	2	2								
Solano.....	29	4	21	8	8	1	8	1	2	3	9	2								
Sonoma.....	21	5	1	1	1	1	1	1	1	1	1	1								
Stanislaus.....	21	5	1	1	1	1	1	1	1	1	1	1								
Sutter.....	1	6	9	2	13	8	20	2	4	45	13	2								
Tehama.....	13	36	1	4	3	4	15	1	9	48	4	3								
Tulare.....	1	1	1	4	3	4	1	16	3	1	1	2								
Tuolumne.....	1	2	1	3	30	2	2	2	1	5	24	3								
Ventura.....	3	1	1	3	3	2	2	2	2	1	1	1								
Yolo.....	1	1	1	1	1	2	14	1	6	1	1	1								
Yuba.....	1	1	1	1	1	2	10	1	2	2	2	2								
Totals.....	389	85	702	195	244	28	684	479	162	326	314	305	336	595	272	260	310	1,091	347	587

[illegible]

DEER KILLED IN DISTRICTS 2-2½-3, AUGUST 1-SEPTEMBER 14, 1930

	Aug. 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Alameda.....	34	18	25	10	6	1	7	7	2	22		4	1		5	5	4			1	4	4	5
Colusa.....	62	27	31	15	11	3	7	5	9	12	1	4	1	1	3	7	11	2	3	3		6	3
Contra Costa.....	2	1																					
Fresno.....	15	4	3	3	6	2	3	1	1	6	3	7	6	2	1	11	4	8	1	2	2	1	1
Glenn.....	143	65	58	19	26	15	13	12	3	19	6	7	6	6	5	11	14	8	6	4	10	6	
Kern.....	15	3	7	2		2	2		1	3		1					2	1		2			
Kings.....	3	4	1	1																			
Lake.....	144	62	72	34	23	21	18	12	16	36	10	14	5	7	12	13	21	11	7	10	6	11	11
Marin.....	47	17	17	5	7	10	5	5	12	17	4	1	7	4	6	11	12	4	4	8	8	2	5
Mendocino.....	175	104	82	43	30	39	19	34	31	51	14	22	19	20	33	25	52	5	16	15	19	16	24
Merced.....	8	4	5	1	1		2		3	6						1	4	2	2	1	1		
Monterey.....	106	70	72	23	19	17	14	14	21	24	4	9	9	8	7	21	27	8	9	9	4	7	15
Napa.....	59	32	46	2	6	7	10	5	14	24	2	6	7	3	7	4	25	7	7	5	7	2	13
San Benito.....	42	19	23	3	9	10	7	4		20	5	3	2	9	1	1	21	2	1	3	3	2	2
San Francisco.....	6																						
San Joaquin.....	57	36	42	13	11	14	13	10	8	1			5	8		1	15	2	7	6	7	8	4
San Luis Obispo.....	11	5	5		2		2	1	3	25	6	6			8	10	15	4		2			
Santa Barbara.....	157	68	60	18	11	15	6	16	12	25	10	11	7	9	9	12	15	9	11	9	5	6	1
Santa Clara.....	70	62	36	13	15	11	5	10	14	23	2	9	9	6	9	15	23	8	2	6	11	4	3
Santa Cruz.....	22	7	10	2	3	3	3	1	1	8	1	3	1	3	1	2	6	2	2	2		2	4
Solano.....	8	2	7	1	3			1	3														
Sonoma.....	78	48	58	18	15	15	8	17	14	19	5	14	7	12	12	29	41	8	12	7	5	8	11
Stanislaus.....	22	6	1	2					1	11	1	1	1	1	1	2	5	1		1	1		3
Ventura.....	71	21	26	7	6	8	7	7	3	12	2	8	4	4	1	2	9	6	3	1	5	4	3
Yolo.....	41	10	15	1	2	4		3	8	8	1	1	1	7	3	6	12	2	2	4	2	2	1
Totals.....	1,407	695	704	236	214	197	151	165	175	383	76	123	96	114	126	173	326	90	96	100	97	92	120

DEER KILLED IN DISTRICTS 2-2½-3, AUGUST 1-SEPTEMBER 14, 1930—Continued

	24	25	26	27	28	29	30	31	Sept. 1	2	3	4	5	6	7	8	9	10	11	12	13	14	Totals
Alameda.....	8		1		3	2	1	10		2	2	1	2	3	12	1	5		1	5	6	22	252
Colusa.....	11	2	2		6	2	3	13	14	3	1	1	2	1	11	3	8	4	4	6	8	11	343
Contra Costa.....								1															6
Fresno.....	12					2		4	2				1	2	4		1	3					86
Glenn.....	13	4	6	5	5	3	7	19	13	2	2	2	2	7	8	7	2	2	5	1	10	7	606
Kern.....		1					1	2							1	1		7	1	1	1	56	
Kings.....																						12	
Lake.....	23	5	4	7	9	4	11	22	25	7	4	6	8	10	25	13	17	15	8	19	26	41	885
Marin.....	15	3	2	2	6	2	9	18	15	7	1	6	7	8	11	6	6	3	7	12	13	25	403
Mendocino.....	35	14	8	9	17	14	23	45	31	9	13	10	22	12	41	41	25	26	24	47	53	76	1,483
Merced.....	5						1		1						4					2	9	1	66
Monterey.....	25	4	2	6	7	7	10	32	18	7	4	12	7	12	32	18	20	10	16	19	31	48	864
Napa.....	18	3	6	3	3	5	9	18	15	3	2	6	3	10	25	6	13	4	12	12	19	41	536
San Benito.....	9	1	3	1	3	1	2	8	3	2		6	4	5	15	2	5	4	11	10	9	17	313
San Francisco.....																							22
San Joaquin.....		1							4	2						1				1		1	58
San Luis Obispo.....	21	4	6	4	2	9	8	11	8	4	6	4	4	17	13	7	5	5	11	16	22	58	568
San Mateo.....	9		2	2	2	2	2	9	4	1	2	3	2	1	4			1	1	2	8	100	
Santa Barbara.....	10	8	3	6	6	3	8	27	16	4	6	3	3	11	32	8	10	9	13	19	29	39	777
Santa Clara.....	20	1	4	3	7	6	11	23	13	4	2	4	6	5	27	8	21	4	13	12	25	52	650
Santa Cruz.....	4		3		1	1	1	5	4				2	2	1	1	2		1				115
Solano.....	2							4	3	2				1	1	2	1	1	5	2		3	58
Sonoma.....																							865
Stanislaus.....	28	10	3	4	9	9	19	45	24	7	9	9	11	10	45	10	22	9	16	11	26	71	865
Ventura.....	4	1		2	1		2	2	1			1		2	1	2	2	2	2	4	11	102	101
Yolo.....	11	1	1	1	5	3	4	10	3	4	1	2		5	6	3	2	3	2	2	11	11	308
	6	3	1	1	4		1	5	1	1	3	2	3	3	11	4	7	3	4	1	6	12	214
Totals.....	279	67	59	57	96	73	134	333	218	71	58	78	89	127	330	144	176	114	156	200	313	557	9,685

DEER KILLED IN DISTRICTS 1-1½-1¾-4-4½-4¾, SEPTEMBER 1-OCTOBER 15, 1930

	Sept. 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Alpine.....																42	23	17	6	6	2	1	
Anador.....																21	2	7	3	6	8	1	1
Butte.....																30	15	9	14	6	15	8	1
Calaveras.....																34	18	12	7	12	22	7	9
Del Norte.....	9	2	1	2	3	1	5			2			2		1				2				
El Dorado.....																103	65	28	15	20	43	7	13
Fresno.....																139	84	68	39	41	35	11	34
Humboldt.....	93	38	29	18	17	18	39	28	36	15	16	14	18	36	8	14	6	5	7	11	25	12	13
Imperial.....																							
Inyo.....																53	20	20	8	14	16	8	4
Kern.....																37	18	9	9	15	25	9	3
Kings.....																							
Lassen.....																							
Los Angeles.....																121	58	36	25	23	33	14	7
Madera.....																101	17	18	7	18	31	21	7
Mariposa.....																85	51	25	27	23	20	3	2
Merced.....																28	8	6	5	3	12	2	5
Modoc.....																							
Mono.....																158	102	87	63	55	50	23	33
Nevada.....																7	8	2	1	3	5	3	
Orange.....																23	13	9	5	15	18	1	6
Placer.....																1	3	2		4	5		2
Plumas.....																55	22	18		8	30		16
Riverside.....																132	77	38	46	39	34	20	30
Sacramento.....																190	67	26	16	11	23	5	8
San Bernardino.....																		1					
San Diego.....																23	8	8	3	5	19	2	2
San Joaquin.....																45	18	11	9	8	12	3	1
Shasta.....																							
Sierra.....																72	33	39	27	20	24	10	19
Siskiyou.....	152	49	40	29	17	18	29	20	22	19	22	17	12	20	12	100	68	47	36	32	36	13	25
Stanislaus.....																2	1						
Sutter.....																							
Tehama.....																54	40	41	29	20	27	13	17
Trinity.....																87	46	52	36	37	32	20	22
Tulare.....																223	110	71	49	47	34	28	25
Tuolumne.....																49	15	12	13	11	16	1	3
Yuba.....																4	5	5	7	8	2	4	1
Totals.....	254	89	70	49	37	37	73	43	68	36	38	31	32	56	21	2,054	1,030	735	528	527	665	257	319

STATEMENT OF EXPENDITURES

For the Period July 1, 1930, to September 30, 1930, of the Eighty-second Fiscal Year

Function	Salaries and wages	Materials and supplies	Service and expense	Property and equipment	Total
Administration:					
Executive	\$1,500 00				\$1,500 00
Clerical and office	5,229 52	\$262 93	\$106 71	\$93 08	5,692 24
Printing		148 25			148 25
Automobiles		72 36		1,483 90	1,572 76
Traveling			16 50		524 34
Postage			1,393 06		1,393 06
Telephone and telegraph			777 28		777 28
Freight, cartage and express			892 22		892 22
Rent			3,851 67		3,851 67
Heat, light and power			27 44		27 44
Accident and death claims			4,350 18		4,350 18
Accounting pro rata	1,125 00				1,125 00
Legal	1,650 00			2 85	1,652 85
Publicity			13 00		13 00
Total, administration	\$9,504 52	\$483 54	\$11,952 40	\$1,579 83	\$23,520 29
Education and research:					
Chief and assistant	\$2,625 00				\$2,625 00
Clerical and office	480 00	\$90 73	\$47 20	\$94 38	712 31
Traveling			1,600 68		1,600 68
Freight, cartage and express			1 50		1 50
Photographer	300 00		25 50	116 70	442 20
Librarian	412 90	1 25	19 00	20 58	453 73
Research	1,275 00	101 40			1,376 40
Publicity			135 01		135 01
Temporary help	200 00				200 00
Summer educational work	546 68				546 68
Total, education and research	\$5,839 58	\$193 38	\$1,828 89	\$231 66	\$8,093 51
Patrol and law enforcement:					
Chief and assistants	\$2,685 00				\$2,685 00
Clerical and office	807 50	\$110 81	\$8 82	\$48 03	975 16
Automobiles		2,120 80	778 33	8,525 10	11,424 23
Traveling			33,420 66		33,420 66
Postage			98 80		98 80
Telephone and telegraph			308 48		308 48
Freight, cartage and express			34 68		34 68
Rent			172 25		172 25
Captains and deputies	52,527 29	34 33	34 60		52,596 22
Launches	510 00	236 54	1,470 44	165 90	2,382 88
Fish planting	1,342 06	364 48	59 50		1,766 04
Volunteer deputies	155 00				155 00
Premiums on bonds			360 00		360 00
Temporary help	20 00				20 00
Total, patrol and law enforcement	\$58,046 85	\$2,866 96	\$36,746 56	\$8,739 03	\$106,399 40
Commercial fisheries:					
Chief and assistants	\$2,595 00				\$2,595 00
Clerical and office	2,295 00	\$7 14	\$35 20		2,337 34
Automobiles		125 96	51 00		176 96
Traveling			3,981 67		3,981 67
Postage			97		97
Telephone and telegraph			57 18		57 18
Freight, cartage and express			21 08		21 08
Rent			197 50		197 50
Heat, light and power			42 69		42 69
Research	2,400 00	5 00		\$43 63	2,448 63
Inspectors	2,976 80				2,976 80
Captains and deputies	3,705 00	30 56	5 15		3,740 71
Launches	3,174 69	1,771 26	1,257 58	2,125 65	8,329 18
Laboratory	8,285 05	183 04	981 90	213 91	9,663 90
Fish tags		202 00			202 00
Salmon tagging			1 00		1 00
Botulism			3,750 00		3,750 00
Statistics	735 00	299 00			1,034 00
Total, commercial fisheries	\$12,666 54	\$2,623 96	\$10,382 92	\$2,383 19	\$41,556 61

STATEMENT OF EXPENDITURES—Continued

For the Period July 1, 1930, to September 30, 1930, of the Eighty-second Fiscal Year

Function	Salaries and wages	Materials and supplies	Service and expense	Property and equipment	Total
Fish culture:					
Chief and assistants	\$1,650 00				\$1,650 00
Clerical and office	975 00	\$33 89	\$9 68		1,018 57
Automobiles		1,381 51	484 96	\$4,335 88	6,202 35
Traveling			3,914 82		3,914 82
Postage			29 00		29 00
Telephone and telegraph			319 10		319 10
Freight, cartage and express			470 80		470 80
Heat, light and power			259 29		259 29
Maintenance			194 07		194 07
Fisheries	35,922 16	24,964 61	423 69	717 41	62,027 87
Fisheries—additions and betterments				4,997 84	4,997 84
Special field investigations	3,458 00	158 48	25 00		3,641 48
Fish cars	1,439 84	217 84	334 28	3 95	1,995 91
Blue printing			4 20		4 20
Total, fish culture	\$43,445 00	\$26,756 33	\$6,468 89	\$10,055 08	\$86,725 30
Hydraulics:					
Chief and assistants	\$1,545 00		\$2 70		\$1,547 70
Clerical and office		\$12 20	3 52		15 72
Automobiles		87 49	37 00	\$1,077 50	1,201 99
Traveling			313 51		313 51
Telephone and telegraph			2 49		2 49
Blue printing			12 40		12 40
Cooperative research	750 00				750 00
Total, hydraulics	\$2,295 00	\$99 69	\$371 62	\$1,077 50	\$3,843 81
Game propagation:					
Superintendents	\$1,880 00				\$1,880 00
Automobiles		\$156 97	\$1 00		157 97
Traveling			355 19		355 19
Postage			5 00		5 00
Telephone and telegraph			47 76		47 76
Freight, cartage and express			30 63		30 63
Heat, light and power			369 97		369 97
Maintenance		3,051 66	121 38	\$1,259 30	4,412 34
Temporary help	1,205 64				1,205 64
Assistants	1,140 00				1,140 00
Total, game propagation	\$4,225 64	\$3,208 63	\$930 93	\$1,239 30	\$9,604 50
Fish rescue:					
Chief and assistants	\$1,155 00	\$9 75	\$35 00		\$1,199 75
Traveling			588 97		588 97
Tent			30 00		30 00
Total, fish rescue	\$1,155 00	\$9 75	\$653 97		\$1,818 72
Game refuges:					
Chief and assistants	\$999 99				\$999 99
Clerical and office	656 00				656 00
Automobiles		\$91 32	\$56 95	\$1,136 32	1,284 59
Freight, cartage and express			50		50
Traveling			272 25		272 25
Game hunters and trappers	2,287 00				2,287 00
Refuge posting	1,710 00	4 80			1,714 80
Predatory animal control			840 00		840 00
Refuge maintenance		158 31	38 68	86 55	283 54
Total, game refuge	\$5,652 99	\$254 43	\$1,208 38	\$1,222 87	\$8,338 67
Sense commissions					\$9,651 55
State fair and other exhibits					\$3,997 06
Year expense—81st fiscal year only					\$1,979 03
Year expense—80th fiscal year only					\$17 87
Grand total, proprietary group					\$305,510 58

STATEMENT OF INCOME

For the Period July 1, 1930, to September 30, 1930, of the Eighty-second Fiscal Year

	Detail	Total
Departmental income—license sales:		
Angling licenses, 1930	\$140,701 50	
Commercial hunting club licenses, 1930-1931	1,100 00	
Commercial hunting club operators licenses, 1930-1931	255 00	
Deer tags, 1930	10,603 00	
Fish importers' licenses, 1930	10 00	
Game breeders' licenses, 1930	85 00	
Hunting licenses, 1930	46,410 70	
Market fishermen's licenses, 1930-1931	20,040 00	
Trapping licenses, 1930-1931	65 00	
Wholesale fish packers' and shell fish dealers' licenses, 1930-1931	775 00	
Wholesale fish packers' and shell fish dealers' licenses, 1929-1930	5 00	
Total license sales		\$220,050 20
Other income:		
Court fines	\$14,682 44	
Fish packers' tax	10,510 82	
Fish tag sales	759 37	
Game tag sales	24 24	
Interest on bank balances	1,648 06	
Kelp tax	45 63	
Miscellaneous sales	301 70	
Total other income		27,972 26
Total departmental income		\$248,022 46
Income for the state university fund:		
Kelp tax	\$22 80	

CALIFORNIA FRESH FISHERY PRODUCTS FOR THE MONTHS OF JULY, AUGUST AND SEPTEMBER, 1930—Continued

	San Luis Obispo, Santa Barbara, Ventura	Los Angeles	Orange	San Diego, Imperial	Total	Fish from south of the International Boundary brought into San Pedro.	Fish from south of the International Boundary brought into San Diego.	Total fish from south of the International Boundary brought into California.
Albacore		13,904		2,077	76,973			
Anchovies		1,415	283		170,068			
Barracuda	1,819	1,080,856	23,590	403,788	1,510,083		67,810	182,842
Bonito	470	2,000,621	12,232	974,851	2,988,621	115,032	47,190	1,124,027
Carp					8,413			
Catfish					80,750			
Cultus Cod	265	350			250,184			
Flounders		143	4		51,710			
Grayfish	30	69,115	23,066	44,236	181,077			
Hake					13,687			
Halibut	81,849	47,341	1,933	1,903	334,667	7,414	116,247	123,661
Herring					344			
Kingfish					74,810			
Mackerel	704	50,282	198	131	2,095,328		719	719
Mackerel—Horse		1,574,938	21,419	113,860	101,503			
Mackerel—Spanish		61,279						
Mullet					11,822		472	472
Pike	1,733	2,409	3,947	5,466	71,788	260		260
Pompano		30,350	218		147			
Rock Bass		307		219	569			
Rockfish	1,859	90,565	63,750	51,625	207,799		130	697
Sablefish	10,311	291,661	3,848	178,448	1,547,996		524	524
Salmon		1,044			491,807			
Sandbars					3,980,109			
Sardines		3,547			305,495			
Sculpin		23,524	270	29,574	74,384,941			
Sea Bass—Black	17	22,378	493	38	22,926			
Sea Bass—White	40	21,404	13,946	14,923	50,313	22,230	26,722	48,952
Shad	40,631	428,133	3,530	201,538	747,504	60,783	163,489	224,272
Shad—Buck					3,356			
Shad—Roe					10			
Sheepshead	167	50,132	626	3,088	54,013			

Skates.....	3,781	24	80,433	1,267,273	3,840,836	5,108,109
Stripjack.....	765,421	2,778	2,823,203		83	83
Smelt.....	62,420	5,773	2,285,612			
Sole.....	13,643	618	2,191,237			
Spittail.....			1,454			
Striped Bass.....			203,426			
Swordfish.....			370,282		1,234	1,234
Tomcod.....	130,473	240	9,261			
Tuna—Bluefin.....	10,683,835	58	10,708,044	2,165,818		2,165,818
Tuna—Yellowfin.....	12,629		35,164	6,291,746	18,779,950	25,071,696
Turbot.....			5,323			
Whitebait.....			29,289			
Whitfish.....	13,825	251	29,067	256		256
Yellowtail.....	147,349	4,876	799,120	1,340,778	559,553	1,900,331
Miscellaneous.....	31,226	975	70,743		1,838	1,838
Total fish.....	17,740,180	188,946	107,161,611	12,348,994	23,606,797	35,955,791
Crustaceans:						
Crabs.....			192,520			
Shrimps.....			1,402,384			
Abalones.....			975,905			
Clams—Cockle.....			17,888			
Clams—Mixed.....			706			
Clams—Pismo.....			33,351			
Clams—Softshell.....			22,847			
Cuttlefish.....			22,900			
Oysters—Eastern.....		30	497,196			
Oysters—Native.....			11,157			
Squid.....			1,523			
Miscellaneous:						
Terrapins.....			58			
Totals.....	311,836	188,976	109,843,646	12,348,994	23,606,797	35,955,791

13,855 dozen.
2,441,800 shell oysters.

STATEMENT OF EXPENDITURES

For the Period July 1, 1929, to June 30, 1930, of the Eighty-first Fiscal Year

Function	Salaries and wages	Materials and supplies	Service and expense	Property and equipment	Total
Administration:					
Executive and legal	\$16,820 00		\$24 70	\$15 40	\$16,860 10
Clerical and office	18,283 90	\$1,187 49	934 73	210 45	20,616 57
Printing		16,193 95			16,193 95
Automobiles		284 71	18 50		303 21
Traveling			4,884 55		4,884 55
Postage			4,591 51		4,591 51
Telephone and telegraph			4,732 23		4,732 23
Freight, cartage and express			2,206 20		2,206 20
Rent			15,328 61		15,328 61
Heat, light and power			305 59		305 59
Accident and death claims			5,234 25		5,234 25
Accounting pro rata	3,600 00				3,600 00
Legal			807 05	22 25	829 30
Publicity			362 18		362 18
Total administration	\$38,703 90	\$17,666 15	\$39,430 10	\$248 10	\$96,048 25
Education and research:					
Chief and assistant	\$7,761 94		\$10 00	\$6 46	\$7,778 40
Clerical and office	1,292 00	\$198 07	258 35	386 01	2,834 43
Traveling			3,828 28		3,828 28
Photographer	1,200 00		251 75	1,575 94	3,007 69
Librarian	1,920 00	97 82	59 29	371 34	2,448 45
Exhibits			40 00	75 00	115 00
Research	4,362 54	403 06		475 34	5,240 94
State fair	276 00	260 71	800 35		1,337 06
Lecturers	2,695 00				2,695 00
Printing		34 80			34 80
Freight, cartage and express			2 00		2 00
Blue printing			13 00		13 00
Publicity			100 93		100 93
Total education and research	\$20,207 48	\$994 46	\$5,343 93	\$2,890 09	\$29,435 96
Publicity:					
Chief of Bureau	\$1,650 00		\$253 61		\$1,903 61
Traveling			39 40		39 40
Total publicity	\$1,650 00		\$293 01		\$1,943 01
Patrol and law enforcement:					
Chief and assistants	\$12,095 00			\$11 55	\$12,106 55
Clerical and office	2,930 00	\$160 81	\$27 28		3,138 09
Automobiles		3,530 94	1,599 68	621 91	5,752 53
Traveling			141,218 97		141,218 97
Captains and deputies	\$208,659 15	\$929 35	\$1,583 60	\$748 00	\$211,920 10
Fish planting	1,993 43	720 69	1,057 32		4,599 44
Watchman	60 00				60 00
Launches	2,040 00	1,269 16	619 42	965 00	4,893 58
Volunteer deputies	555 00	38 50	5 00		598 50
Premiums on bonds			4,843 41		4,843 41
Freight, cartage and express			4 77		4 77
Rent			417 91		417 91
Total patrol and law enforcement	\$228,352 58	\$8,649 45	\$151,377 36	\$3,174 46	\$389,553 85
Commercial fisheries:					
Chief and assistants	\$10,500 00			\$7 47	\$10,507 47
Clerical and office	8,976 89	\$164 84	\$62 09	34 45	9,238 27
Automobiles		386 85	89 12	506 02	901 99
Traveling			19,204 68		19,204 68
Research	6,529 83	8 25		302 70	6,840 76
Captains and deputies	15,058 03	165 50	34 57	117 34	15,375 44
Launches	5,674 47	3,494 42	3,204 25	277 76	12,650 90
Statistics	2,940 00	458 70			3,398 70
Laboratory	31,474 74	1,021 15	2,118 05	690 72	35,304 66
Fish tags		412 50			412 50
Botulism			15,000 00		15,000 00
Hydro-Biological Survey Monterey Bay			1,500 00		1,500 00
Inspectors	28,694 50				28,694 50
Temporary help	319 25				319 25
Postage			20 00		20 00
Freight, cartage and express			73 09		73 09
Heat, light and power			7 49		7 49
Total commercial fisheries	\$110,167 71	\$6,032 19	\$41,313 34	\$1,936 46	\$159,449 70

STATEMENT OF EXPENDITURES—Continued

For the Period July 1, 1929, to June 30, 1930, of the Eighty-first Fiscal Year

Function	Salaries and wages	Materials and supplies	Service and expense	Property and equipment	Total
Fish culture:					
Chief and assistants	\$6,600 00				\$6,600 00
Clerical and office	3,900 00	\$65 82	\$14 00	\$5 05	\$3,982 87
Automobiles		4,664 03	2,078 30	1,771 31	8,513 64
Traveling			13,445 51		13,445 51
Telephone and telegraph			850 82		850 82
Rent			1,152 85		1,152 85
Heat, light and power			905 70		905 70
Hatcheries	131,937 83	67,305 32	2,498 20	2,717 20	204,458 55
Hatcheries—additions and betterments				17,976 18	17,976 18
Special field investigations	11,758 00	61 61	233 08		12,052 69
Fish cars		262 78	2,304 79		2,567 57
Freight, cartage and express			1,429 53		1,429 53
Blue printing			17 00		17 00
Total fish culture	\$154,195 83	\$72,359 56	\$24,929 78	\$22,467 74	\$273,952 91
Hydraulics:					
Chief and assistants	\$6,060 00		\$18 37		\$6,078 37
Clerical and office		\$51 78	28 73		80 51
Automobiles		498 70	146 40		645 10
Traveling			1,453 37		1,453 37
Cooperative research	2,459 55	2 10	38 25		2,500 00
Blue printing			30 93		30 93
Total hydraulics	\$8,519 65	\$552 58	\$1,716 05		\$10,788 28
Game propagation:					
Superintendents	\$4,914 17				\$4,914 17
Automobiles		\$325 12	\$48 49	\$1,986 01	2,359 62
Traveling			2,269 98		2,269 98
Heat, light and power			787 65		787 65
Laborers	8,476 54				8,476 54
Maintenance		10,391 41	1,663 44	4,397 28	16,452 13
Telephone and telegraph			151 55		151 55
Freight, cartage and express			141 71		141 71
Total game propagation	\$13,390 71	\$10,716 53	\$5,062 82	\$6,383 29	\$35,553 55
Fish rescue:					
Chief and assistants	\$4,669 00	\$3 69	\$127 60	\$4 10	\$4,804 39
Traveling			1,867 48		1,867 48
Rent			129 00		129 00
Heat, light, water and power			9 00		9 00
Total fish rescue	\$4,669 00	\$3 69	\$2,133 08	\$4 10	\$6,809 87
Game refuge:					
Chief and assistants	\$4,000 00				\$4,000 00
Clerical and office	1,800 00	\$5 27	\$1 25		1,806 52
Automobiles		511 47	307 62		819 09
Traveling			1,305 22		1,305 22
Lion hunters and trappers	7,661 79				7,661 79
Refuge posting	2,962 71	73 33	49 92		3,985 96
Game refuge supplies		177 92	44 37		222 29
Lion bounties			6,710 00		6,710 00
Total game refuge	\$16,424 50	\$767 99	\$8,418 38		\$25,610 87

STATEMENT OF EXPENDITURES—Continued

For the Period July 1, 1929, to June 30, 1930, of the Eighty-first Fiscal Year

Function	Service and expense	Total
License commissions.....	\$49,961 41	\$49,961 41
Purchase of game refuges.....		4,558 98
Purchase of Hungarian partridges.....		4,759 73
Construction of Russian River jetties.....		17,750 00
Expenditures to pay claims for returns of fish and game licenses.....		83 50
Expenditure to pay claim of Harry L. Hopper.....		658 50
Prior year.....		192,988 70
Grand totals.....	\$49,961 41	\$1,299,906 87

STATEMENT OF INCOME

For the Period July 1, 1929, to June 30, 1929, of the Eighty-first Fiscal Year

License sales	Detail	Total
Angling, 1929.....	\$395,537 95	
Angling, 1930.....	79,671 90	
Commercial hunting club licenses, 1929-30.....	2,550 00	
Commercial hunting club operators' licenses, 1929-30.....	820 00	
Deer tag licenses, 1929.....	115,471 80	
Fish breeders' licenses, 1929.....	75 00	
Fish breeders' licenses, 1930.....	425 00	
Fish importers' licenses, 1929.....	55 00	
Fish importers' licenses, 1930.....	95 00	
Game breeders' licenses, 1929.....	195 00	
Game breeders' licenses, 1930.....	827 50	
Hunting licenses, 1929.....	447,723 87	
Hunting licenses, 1930.....	24,213 90	
Kelp licenses, 1929.....	10 00	
Kelp licenses, 1930.....	50 00	
Market fishermen's licenses, 1929-30.....	29,170 00	
Market fishermen's licenses, 1930-31.....	32,110 00	
Trapping licenses, 1929-30.....	4,438 00	
Wholesale fish packers' and shell fish dealers' licenses, 1929-30.....	1,320 00	
Wholesale fish packers' and shell fish dealers' licenses, 1928-29.....	20 00	
Total license sales.....		\$1,134,689 92
Other income:		
Game tag sales.....	\$51 69	
Court fines.....	84,872 40	
Fish packers' tax.....	202,596 07	
Kelp tax.....	105 97	
Fish tag sales.....	3,398 84	
Miscellaneous sales.....	1,027 12	
Interest on bank balances.....	5,191 20	
Total other income.....		297,043 29
Total departmental income.....		\$1,431,733 21